



Dynegy Midwest Generation, Inc.

Havana Power Station Havana, Illinois

East Ash Pond System

IDNR Dam Safety Program

Permit No. DS2002185

Dam ID No. IL50483

Operations and Maintenance Plan

November 2008

Havana Power Station East Ash Pond System Class 1 Dam Operations and Maintenance Plan

1.0 General

The following operation and maintenance procedures are provided to maintain the structural integrity of the east ash pond system (cells 1, 2, 3, and the final polishing pond - cell 4). Cells 1 and 2, and the final polishing pond of this system are classified as Small Class 1 dams by the Illinois Department of Natural Resources, Office of Water Resources (IDNR_OWR). Cell 3 is classified as an Intermediate Class 1 dam.

Cells 1, 2, and 3 are the primary ash deposition cells of the system. The fourth cell is the final effluent polishing pond. Cells 1, 2, and 3 are not hydraulically connected.

Water elevations in cell 4 will be slightly lower than in cells 1, 2, or 3. The normal pool elevation of primary cells 1 and 2 of this system is 486 feet above msl. Cell 1 is currently used only for the deposition of bottom ash and there is minimal free standing water in the pond. Cell 2 was taken out of service after cell 3 was constructed and placed into service (2003).

The normal pool elevation of cell no. 3 is 492 feet above msl. The <u>emergency</u> spillway crest in cell 3 is at approximate elevation 494 feet above msl. This emergency spillway consists of a concrete overflow channel which would discharge to the final effluent polishing pond.

2.0 Operation

2.1 Normal Operation and Surveillance

Ash disposal facility operation will be controlled by limiting discharges from the station to cells 1, 2, or 3 and by varying water surface elevations at the final effluent polishing pond (cell 4) discharge structure.

(a) Ash Pond Monitoring

An <u>Ash Pond Log</u> shall be used to establish and maintain pond history. All inspections and maintenance activities shall be recorded. Responsibility for maintaining this log shall be designated by the Station Manager.

(b) Daily Surveillance

The water surface elevation of each cell of the ash pond system shall be observed and recorded daily in the <u>Ash Pond Log</u>. A staff gauge is installed in each cell of the system and these gauges shall be maintained such that they accurately indicate water level elevations in each cell.

(c) Weekly Surveillance and Inspection

Weekly inspections of the perimeter berms around cells 1, 2, 3, and 4 shall be conducted, looking for seepage and slumping, and unusual seepage at and/or blockage of the outfall structures in each cell. All findings shall be entered into the <u>Ash Pond Log</u> and maintenance activities shall be initiated, if required.

2.2 Emergency Action Plan

During and immediately following unusual storm and flood events, inspection of the cells and their appurtenances shall be carried out and recorded at least once each day.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 487 feet or 492.7 feet in cell 3, inspection of the cells and their appurtenances shall be carried out and recorded at least once every 12 hours.

If the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 488 feet or 494 feet in cell 3, a downstream flood <u>watch</u> will be disseminated and discharges from the station to the ash pond system will be suspended. Inspection of the cells and their appurtenances shall be carried out and recorded at least once every four hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489 feet or 495 feet in cell 3, a flood <u>warning</u> will be disseminated and downstream residents that could experience first floor flooding shall be evacuated. Inspection of the ponds and their appurtenances shall be carried out and recorded at least once every two hours.

When the staff gauge in either cell 1 or cell 2 indicates a pool elevation of 489.25 feet or 495.25 feet in cell 3, all residents within the breach wave area shall be evacuated. Inspection of the ponds and their appurtenances shall be performed and recorded continuously. Residents will not be permitted to return to the breach wave area until the event concludes, the water surface in the cells fall to normal pool levels, and complete inspection of the cells and their appurtenances indicate pond operation to be safe.

Any unusual condition discovered during major storm events or routine inspection which may constitute an emergency shall be communicated as follows:

- Notice of any type of emergency involving the berms or outfall shall be made to the Shift Leader on duty.
- The shift leader on duty shall then notify the Station Manager (A.K. Millis; pager and home tel. nos. 309-297-0105; 309-692-8228; kirk_millis @dynegy.com) or in his absence the Production Manager (B.W. Veech; pager and home telephone nos. 309-303-5678 and 815-664-2608, respectively; e-mail address: byron_veech @dynegy.com). One of these shall then notify the following city, county, state, and federal regulatory authorities:

	Illinois ESDA, 24-hour service	1-800-782-7860
*	IDNR_OWR, Dam Safety Section	217-782-3863
*	IDOT, District 6	. 217-782-7301
*	Mason County Sheriff	309-543-2231
*	Havana Police Department	. 309-543-3321
	DMG, Director of Construction	. 618-206-5801
	DMG, Operations and Environmental Compliance(OEC	5)
		618-206-5934 (office)
		618-288-5659 (home)
		618-401-5060 (cellular)

2.3 <u>Dewatering</u>

The Station Manager or the Production Manager shall be responsible for determining how repairs shall be accomplished and whether dewatering of the ash pond cells is necessary. Dewatering shall be accomplished by (a) manually removing the concrete stop logs from cell 4 of the ash pond system and (b) pumping of water from cell 1, or cell 2, or cell 3 to cell 4.

If water from cell 1, cell 2, or cell 3 must be <u>rapidly</u> drained to cell 4, the <u>internal</u> berm between cell 1 and cell 4, or between cell 2 and cell 4, or between cell 3 and cell 4 should be breached, but in a controlled manner. Only portions of a berm should be removed to maintain equalized water levels in cell 4. Breaching should be constantly manned and monitored by station personnel until water levels are equalized. Heavy equipment should be kept available so that, if excessive erosion of a berm begins to occur, berm materials can be replaced.

3.0 Maintenance

3.1. Semiannual Inspections

Semiannual inspections shall be conducted during optimal conditions at approximately six-month intervals to determine the general condition of the berms and discharge structure. Degradation of riprap, berm erosion, tree growth, animal burrows, and berm seepage shall be monitored during these inspections.

3.2 Vegetation

Berms shall be maintained to protect the structural integrity of the ash ponds. Damaged and barren areas shall be repaired as soon as appropriate with topsoil, limed, fertilized, and seeded with appropriate vegetation. Refer to Appendix A for a repair design suggestion.

Trees and shrubs observed during semiannual inspections shall be cut and removed from the berms. This shall be done as frequently as is necessary to insure that no tree reaches a size where the root structure would require removal and filling. Woody vegetation, shrubs, and trees shall be removed during the early stages of growth before reaching a 3-inch diameter. Low-growing vegetation that will not interfere with inspections shall be planted and maintained. Grass on the slopes of the berms should not be allowed to grow greater than 12 inches in height.

3.3. <u>Intermediate Standpipe Structures, Final Discharge Structure, and Effluent Piping</u>

Intermediate standpipe structures (which allow water to flow from cell to cell) shall be inspected semiannually for significant corrosion, scaling, etc. Structures significantly corroded shall be promptly repaired or replaced. Substantial deposits of scale shall be removed.

The final discharge structure shall be inspected semiannually for significant corrosion and for spalling and cracking of the concrete beams present in the structure. Any defects discovered shall be promptly repaired.

Effluent piping shall be inspected semiannually for excessive corrosion or scaling. Pipe which is significantly corroded shall be promptly replaced. Substantial scale deposits shall be removed. Effluent piping channels shall be inspected semiannual for seepage (infiltration) and corrosion. Excessive infiltration and corrosion shall be repaired.

Erosion of berms around the discharge structure or intermediate standpipe structures be promptly corrected by revetment with riprap or another erosion control method. Refer to Appendix A for a repair design suggestion.

3.4. Animal Damage and Repairs

Animal burrows discovered during inspections shall be promptly repaired by filling with grout.

3.5 Restriction of Unauthorized Vehicles and Personnel

Berm approaches shall be posted with signs and the entire site enclosed by security fencing to prevent unauthorized travel on the roadways and slopes.

3.6. Annual Inspection

An annual inspection shall be made by a licensed Professional Engineer. This inspection shall follow IDNR's "Guidelines and Forms for Inspection of Illinois Dams", and shall be followed by verbal and written reports by the consulting engineer. Based on the findings of the inspection, the Station Manager shall implement corrective action as required to promote dam safety. Procedures and methods for corrective action shall be performed in accordance with the recommendations of the consulting engineer and as outlined above. Copies of the engineer's report along with the corrective action taken shall be reported to the IDNR. An annual statement on forms furnished by the IDNR certifying compliance with the above maintenance plan shall be submitted to the IDNR.

Havana Station IDNR O&M Plan



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 – (217) 782-3397 James R. Thompson Center, 100 West Randolph, Suite 11-300, Chicago, IL 60601 – (312) 814-6026 Douglas P. Scott, Director

May 22, 2009

Mr. Rick Diericx Senior Director, Operations Environmental Compliance Dynegy Midwest Region Operations 604 Pierce Boulevard O'Fallon, Illinois 62269

Dear Mr. Diericx:

This letter is in response to Dynegy's "2008 Closure Work Plan Annual Report" (Annual Report) and cover letter for the Havana South Ash Pond System, received by the Illinois Environmental Protection Agency (Illinois EPA) on October 6, 2008.

In the cover letter, Dynegy requests that the Illinois EPA give written approval for the discontinuation of all Groundwater monitoring at the South Ash Pond site and provide a declaration of closure. Such action will cause the groundwater management zone (GMZ) established June 1996, in accordance with consent decree 89-CH-5, to expire.

Pursuant to 35 IAC 620.250(c):

A groundwater management zone expires upon the Agency's receipt of appropriate documentation which confirms the completion of the action taken pursuant to subsection (a) and which confirms the attainment of applicable standards as set forth in Subpart D.

The Annual Report provides data indicating that during the most recent five years of monitoring, four monitoring wells Well 04, Well 15, Well 23 and Well 25 have had boron and/or manganese concentrations higher than the Class I numerical groundwater standard. No other monitoring wells have exceeded the Class I numerical groundwater standards (35 IAC 620.410) during that time period.

Based on the data provided, Well 23 is within the outer most edge (620.240(f)(1)) of the closed impoundment. The applicable groundwater standard is Class IV groundwater. The Class IV groundwater standards are equal to existing concentrations (i.e. constituent concentrations must not increase). The monitoring data provided indicates that both boron and manganese concentrations show a decreasing trend in Well 23. Therefore, Well 23 appears to be in compliance with the applicable standards of 35 IAC 620.

ROCKFORD - 4302 North Main Street, Rockford, IL 61103 - (815) 987-7760

EIGIN - 595 South State, Elgin, IL 60123 - (847) 608-3131

PEORIA - 5415 N. University St., Peoria, IL 61614 - (309) 693-5463

BUREAU OF LAND - PEORIA - 7620 N. University St., Peoria, IL 61614 - (309) 693-5462

SPRINGFIELD - 4500 S. Sixth Street Rd., Springfield, IL 62706 - (217) 786-6892

MARION - 2309 W. Main St., Suite 116, Marion, IL 62959 - (618) 993-7200

DES PLAINES - 9511 W. Harrison St., Des Plaines, IL 60016 - (847) 294-4000

FEORIA - 5415 N. University St., Peoria, IL 61614 - (309) 693-5463

CHAMPAICH - 2125 South First Street, Champaign, IL 61820 - (217) 278-5800

COLLINSVILLE - 2009 Mall Street, Collinsville, IL 62234 - (618) 346-5120

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While Well 25 is within 25 feet of the edge of the closed impoundment, available data indicates that the well is screened more than 15 feet below the base of the impoundment, and is therefore monitoring Class I groundwater. Wells 04 and 15 are down gradient and are also monitoring Class I groundwater. During the most recent five years of monitoring all three of these wells have had manganese concentrations higher than the Class I numerical groundwater standard.

Pursuant to 35 IAC 620.410(a)

Inorganic Chemical Constituents

Except due to natural causes or as provided in Section 620.450, concentrations of the following chemical constituents must not be exceeded in Class I groundwater:

Based on a review of the monitoring data provided and the conclusions of the 2002 EPRI report, the concentrations of manganese in these three wells appear to be due to natural aquifer conditions. Under these circumstances, Wells 04, 15 and 25 are in compliance with the applicable standards of 35 IAC 620.450(a)(4)(A), and no reporting pursuant to 35 IAC 620.450(a)(5) is required.

Based on the Illinois EPA's review and interpretation of the data submitted by Dynegy, the requirements of 35 IAC 620.250(c) have been satisfied. Therefore, the Havana South Ash Pond GMZ shall expire as of the date of this letter. The Havana South Ash Pond is considered to be closed and no further monitoring or reporting is required pursuant to the GMZ.

I trust this responds to your needs. If you have further questions or concerns please contact Lynn Dunaway of my staff or me at (217) 785-4787.

Sincerely,

William E. Buscher, P.G.

Supervisor, Hydogeology and Compliance Unit

Groundwater Section

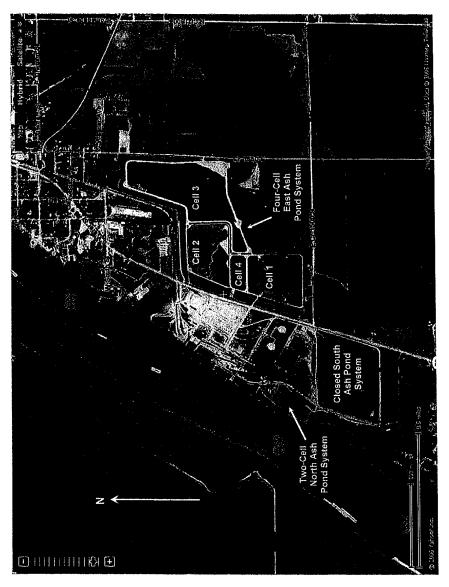
Division of Public Water Supplies

William 9. Pasches

Bureau of Water

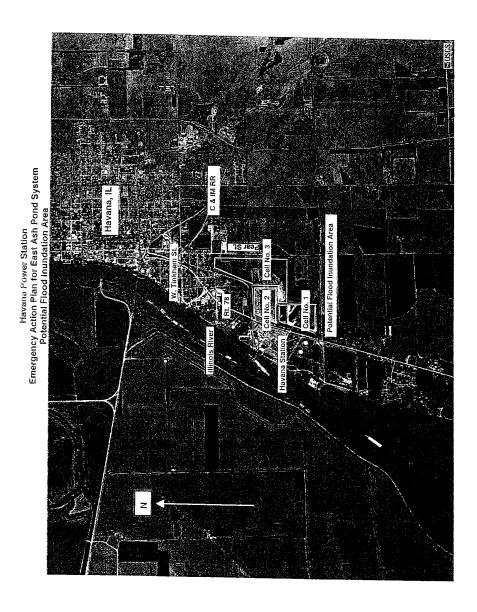
CC: Al Keller, BOW Permits

Connie Tonsor, DLC Mike Garretson, CAS Lynn Dunaway Groundwater File



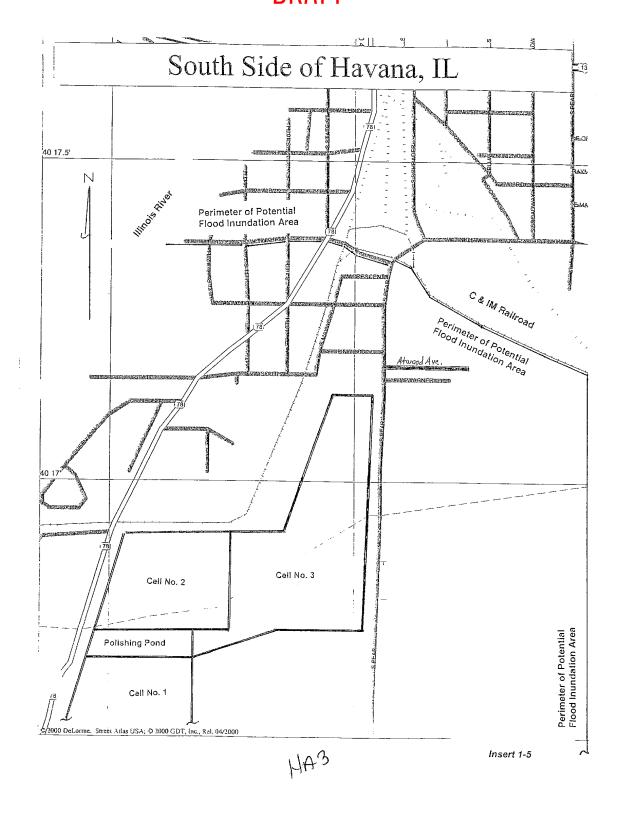
Havana Station Ash Pond Systems

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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DOUGLAS P. SCOTT, DIRECTOR

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Bureau of Water

CC.

Al Keller, BOW Permits Connie Tonsor, DLC

Mike Garretson, CAS Lynn Dunaway

Groundwater File

HAS



Design Calculations and Commentary Submitted for a Dam Safety Construction Permit

Dynegy-Illinois Power Havana Power Plant East Ash Pond #3

January 2002

062 044275 REGISTERED PROFESSIONAL ENGINEER

Aavid M. Laskins 1/14/02 license expires 11/30/03

HAL

Design Calculations and Commentary Submitted for a Dam Safety Construction Permit

> Dynegy- Illinois Power Havana Power Plant East Ash Pond #3

January 2002

HAM

Design Calculations and Commentary Submitted for a Dam Safety Construction Permit

> Dynegy- Illinois Power Havana Power Plant East Ash Pond #3

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Introduction to Engineering Calcs. Havana Power Station East Ash Pond #3B September 14, 2001

This manual contains the engineering calculations for the #3B cell of the Havana Power Plant East Ash Pond system. This facility is owned and operated by Illinois Power Company of Decatur, Illinois, a subsidiary of Dynegy, Corp. Its construction will be very similar to the initial ponds of the east ash pond system built in 1992/93 under permit number 20748 and the pond system built in 1998/99 under permit number. The most significant change in construction between the #3B cell and the initial ponds will be the relative size of the new pond, with a storage volume over 2.2 million cubic yards.

The liner for cell #3B will consist of one foot of compacted glacial till clay brought in from off site covered with a 45-mil polypropylene geomembrane. The membrane is essentially impervious to water. The clay layer is to provide additional protection against seepage in the event of pinholes or seaming defects in the membrane. The ponds built in 1992/93 have a three-foot clay liner without a geomembrane.

The maximum toe to crest height for the cell #3B embankment is 34 feet.

Cell #3B will receive no stormwater runoff except for rain that falls directly on the cell or the top of the embankment. All plant waste streams currently going to cell #2 will be redirected to the new cell. These result in a maximum of 11.9-cfs flow into the pond. In an emergency, plant flows can be shut off in a relatively short time.

Outflow from cell #3B will go to the existing polishing pond. From there, the existing outlet works will carry the water to a backwater area of the Illinois River. The only new piping work is the standpipe in cell #3B that directs the outflow to the polishing pond.

The accompanying project plans show the construction details for the new cell. The embankment will be constructed of the on-site soils compacted to no less than 95% of the Standard Proctor density. The clay liner will also be compacted to not less than 95% of Standard Proctor density. A competent inspector, who has experience in this type of work, will observe all construction. The inspector will be hired by the Owner and will be completely independent of the construction contractor. Furthermore, the Illinois Power Engineering Department will closely follow the project from start to finish.

These calculations are intended for submittal to the Illinois Department of Natural Resources, Office of Water Resources for a construction permit. They have been prepared in accordance with the following Office of Water Resources publications:

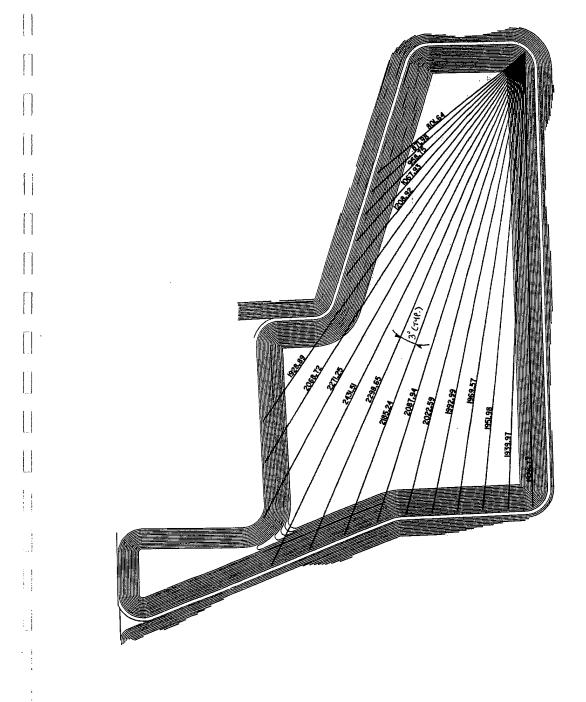
- 1. Rules for Construction and Maintenance of Dams
- 2. Procedural Guidelines for Preparation of Technical Data to be Included for Permits for Construction and Maintenance of Dams

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The table of contents lists the scope of these calculations. They cover hydrology, hydraulics and geotechnical concerns. There are no components of this dam that require structural calculations.

The greatest risk to life and property in the event of a dam breach of the pond system is on State Highway 78 immediately west of cell #2, the power plant adjacent to the highway and the rural township road immediately east of cell #3B and the houses adjacent to the road. The main channel of the Illinois River is approximately ½ mile west of cell #3B. The risk to life and property along the Illinois River caused by a breach of cell #3B is very small.

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Havana East Ash Pond #3B

Fetch Lengths for Wave Runup Analysis

Angle (degrees)	Length (ft.)	Length (mile)	cosine alpha	Length*cos. (mi.)
				İ
18	1928.89	0.365	0.951	0.347
15	2068.72	0.392	0.966	0.378
12	2271.25	0.430	0.978	0.421
9	2431.51	0.461	0.988	0.455
6	2298.65	0.435	0.995	0.433
3	2185.24	0.414	0.999	0.413
0	2087,94	0.395	1.000	0.395
3	2022.59	0.383	0.999	0.383
6	1992.99	0.377	0.995	0.375
9	1969.57	0.373	0.988	0.368
12	1951.98	0.370	0.978	0.362
15	1939.97	0.367	0.966	0.355
18	1928.77	0.365	0.951	0.347

Summations:

12.753

5.034

Feff. = 5.034/12.753 = 0.395 miles

	Subject: Wave Runup and Freeboard calculation for Pond #3B
	Purpose: Calculate the maximum wave runup and freeboard required in Pond #3B of Havana East Ash Pond. Pond.
	, did.
	II. Assumptions, inputs and references:
	References: 1.) "Wave Runup and Wind Setup on Reservoir Embankments", U.S. Army Corps of Engineers, Office of the Chief of Engineers, ETL 1110-2-221, November 1976.
	2.) "Wave Characteristics, Wave Runup and Wind Setup Computational Model" program manual by B.R. Bodine, Corps of Engineers Southwestern Division, January 1986.
	3.) Calculations done for Havana East ash pond #2
	4.) 100-yr, 24 hr. rainfall from Frequency Distributions of Heavy Rainstorms in Illinois, Illinois State Water Survey, 1989
1.	

HA13

11/02/01 Designer JHK Project No. Havana Project Subject: Wave Runup and Freeboard calculation for Pond #3B Methodology 111. Using the methodology outlined in Ref. 1 & 2, calculate the wave runup from the normal water elevation at 492' and check against the freeboard provided of 4' between top of dam at elevation 496' and water elevation of 492'. IV. Analysis and Results: Top of dam elevation= 496' Normal water elevation= 492' Pond bottom elevation= 455' Pond depth at toe of slope (elev. 492' - elev. 458') = 34' Embankment Slope of 3:1 Volume at elev. 492' = 1,993,412 cu. Yd = 53,822,129 cu. Ft. Area at elev. 492' = 1,928,963 sq. ft. Max. overland winds: 1-min. = 65 mph 1-hr. = 43 mph 2-hr. wind estimated at 96% of 1-hr. wind 2-hr. = 0.96*43 = 41.3 mph . Maximum fetch = 0.395 mi. (See Excel Spreadsheet output) From fig. 11 of Ref. 1: 6-min. dur. - 58 mph 8-min. dur. - 28 mph 10-min. dur. - 17 mph From Ref.2: Using a U_{p} = 65 mph design wind and $F_{\text{eff.}}$ = 0.395 mi., $U_A = 0.589 (U_D)^{1.23}$ $= 0.589(65)^{1.23}$ = 100 mph

HAH

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Subject: Wave Runup and Freeboard calculation for Pond #3B
      H_0 = 0.0301(U_{\scriptscriptstyle A})F^{1/2}
         = 0.0301(100)0.395^{1/2}
          = 1.89'
      \mathsf{T} = 0.559[(\mathsf{U}_{\mathsf{A}})\mathsf{F}]^{1/3}
       = 0.559[(100)0.395]^{1/3}
        = 1.90 sec.
      L_0 = 5.12x(T^2) where L_0 = wave length = 5.12(1.90)^2
         = 18.56'
      L<sub>1</sub>/2 = 9.28' < avg. pond depth, therefore waves are not affected by bottom
       R_s = (H_0 \sin \theta)[(5.95 \tan \theta) + 1.5][0.123L_0/H_0]^a
       where a= (1.58-2.35 tan \theta + 0.092 cot \theta - 0.26)(H<sub>0</sub>/d<sub>s</sub>) and d<sub>s</sub> = depth of water at toe of slope
                = [1.58-2.35(1/3) +0.092(3) -0.26](1.89/34')
                 = 0.0452
       and \theta= embankment slope and \tan \theta = 1/3
       R_s = (1.89' \sin 18.43')[(5.95/3) +1.5](0.123x18.56'/1.89')^{0.0452}
          = 2.10'
       R_{\rm m} = 1.517 R_{\rm s}
          = 3.18'
       Wind setup
       S = U^2F_u/1440D, where U= wind speed (mph), F_u=2x(fetch distance) and D= avg. depth
       S = 68^{2}(2)(0.395)/1440x34' = 0.075'
       Maximum elevation = 3.18'+0.075'+ 492.68' (max. stage elev. from Havana1.out output)
                               = 495.93' ~ 496' (Acceptable, since location is only at one point with wind
                                                   blowing in most critical direction and with maximum wind and
                                                   stage elev.)
                           Wave Runup and Freeboard acceptable.
```



Hydrologic Analysis/ Spillway Analysis Havana Power Station East Ash Pond #3B November 7, 2001 JHK

The pond system meets the following two design criteria:

- 1. For the main spillway, a 100-yr., 24-hr. storm plus maximum plant flow must be safely routed through the pond system. This equals a 7-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).
- For the emergency spillway, a storm equal to one-half the PMP storm plus maximum plant flow must be safely routed through the pond system. One half the PMP equals a 16-inch rainfall in 24 hours plus a plant flow of 11.9 cfs (7.70 MGD).

For the pond system, the main spillway and emergency spillway are the same. Standpipes in ponds 1, 2 and 3B, discharge into pond 3. A stoplog structure in pond 3 discharges into an underground 36-inch RCCP that carries the water to the Illinois River. With the exception of the standpipe in the proposed pond 3B, all the outlet structures are existing.

As part of the construction of the new pond, a secondary emergency spillway will be added between ponds 3B and 3. This spillway will be a concrete-lined overflow spillway. It would receive flow only if the 36-inch pipe between ponds 3B and existing pond 3 should become blocked.

From the HEC-1 computer program, the following results were obtained. The HEC-1 runs were run using both the maximum pipe discharge capacity and the pipe discharge capacity based on weir equation. For the $\frac{1}{2}$ PMP storm, the stoplog discharge capacity was based on the weir with end contractions equation. The maximum pond elevations for the 100-yr. storm are below the maximum pond level, as established by wave run-up and setup calculations. It is assumed that wave action will be limited during a $\frac{1}{2}$ PMP storm.

Pond	½ the PMP storm max. elevation (feet)	max. discharge (cfs)
1	486.92	23
2	486.57	35
3B	493.17	40
3	486.79	93
Pond	100-yr., 24-hour storm max. elevation (feet)	max. discharge (cfs)

Pond	max. elevation (feet)	max. discharge (cfs)	
1	486.41	8	
$\hat{2}$	486.21	19	
3B	492.68	18	
3	485.63	42	

HA 16

References used:

- Frequency Distributions of Heavy Rainstorms in Illinois, Illinois State Water Survey, 1989.
- 2. Effects of Basin Rainfall Estimates on Dam Safety Design in Illinois, Illinois State Water Survey, Surface Water Division, 1981.



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Stage-Storage Relationship- Pond 1 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres	
486.00	0.00	20.93	
486.50	10.53	21.17	
487.00	21.17	21.42	
487.50	31.94	21.66	
488.00	42.84	21.91	
488.50	53.85	22.15	
489.00	64.98	22.39	
489.50	76.24	22.64	
490.00	87.62	22.88	

Normal pool elevation:

486'

Area at normal elevation:

20.93 acres = 911,818 sq. ft.

Max. pool elevation:

490'

Area at max. elevation:

22.88 acres = 996,705 sq. ft.

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Stage-Discharge Relationship- Pond 1 at Havana Power Station

Weir Equation	Input
Q = CLH^1.5	D= dia. of standpipe = 30"
L= PI*D	H= head increment
C= 3 33	

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	486.00	0.00	0.00	
	486.50	0.50	9.25	
	487.00	1.00	26.15	
pipe flow begins	487.50	1.50	48.05	
	488.00	2.00	73.97	
	488.50	2.50	103.38	
	489.00	3.00	135.90	
	489.50	3.50	171.25	
	490.00	4.00	209.23	

Normal pool elevation: 486'

Area at normal elevation: 20.93 acres = 911,818 sq. ft.

Max. pool elevation: 490'

Area at max. elevation: 22.88 acres = 996,705 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.0' head of water. This is conservative for pipe evaluation.

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Stage-Discharge Relationship- Pond 2 at Havana Power Station

Weir Equation	Input
Q = CLH^1.5 L= PI*D C= 3.33	D= dia. of standpipe = 36" H= head increment

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	485.50	0.00	0.00	
	486.00	0.50	11.10	
	486.50	1.00	31.38	
pipe flow begins	487.00	1.50	57.66	
	487.50	2.00	88.77	
	488.00	2.50	124.06	
	488.50	3.00	163.08	
	489.00	3.50	205.50	
	489.50	4.00	251.08	
	490.00	4.50	299.59	

Normal pool elevation:

486'

Area at normal elevation:

19.4 acres = 845,135 sq. ft.

Max. pool elevation:

490'

Area at max. elevation:

20.48 acres = 891,891 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.



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Stage-Storage Relationship- Pond 2 at Havana Power Station

Stage (ft)	e (ft) Storage (acre-ft) Water surface area (a	
486.00	0.00	19.40
486.50	9.73	19.54
487.00	19.54	19.67
487.50	29.40	19.80
488.00	39.34	19.94
488.50	49.34	20.07
489.00	59.41	20.21
489.50	69.55	20.34
490.00	79 75	20.48

Normal pool elevation:

486'

Area at normal elevation:

19.40 acres = 845,135 sq. ft.

Max. pool elevation:

490'

Area at max elevation;

20.48 acres = 891,891 sq. ft.

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11/2/01

Stage-Discharge Relationship- Pond 3B at Havana Power Station

Weir Equation	Input
Q = CLH^1.5 L= PI*D C= 3.33	D= dia. of standpipe = 36" H= head increment

Comments	Stage (ft)	Head (ft)	Q (cfs)	
elev. of standpipe	492.00	0.00	0.00	
	492.50	0.50	11.10	
	493.00	1.00	31.38	
pipe flow begins	493.50	1.50	57.66	
	494.00	2.00	88.77	
	494.50	2.50	124.06	
	495.00	3.00	163.08	
	495.50	3.50	205.50	
	496.00	4.00	251.08	

Normal pool elevation:

492'

Area at normal elevation:

44.28 acres = 1,928,963 sq. ft.

Max. pool elevation:

406'

Area at max. elevation:

46.28 acres = 2,016,020 sq. ft.

Two cases will be considered:

- 1.) Max. weir flow with head of 0.5(pipe diameter). This is conservative for the evaluation of the pond
- 2.) Max. pipe flow with 4.5' head of water. This is conservative for pipe evaluation.



11/2/01

Stage-Storage Relationship- Pond 3B at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
492.00	0.00	44.28
492.50	22.20	44.53
493.00	44.53	44.78
493.50	66.98	45.03
494.00	89.56	45.28
494.50	112.26	45.53
495.00	135.09	45.78
495.50	158.04	46.03
496.00	181.12	46.28

Normal pool elevation:

492'

Area at normal elevation:

44.28 acres = 1,928,963 sq. ft.

Max. pool elevation:

496'

Area at max. elevation:

46.28 acres = 2,016,020 sq. ft.



Stage-Discharge Relationship- Polishing Pond 3 at Havana

Weir Equation

Q = 3.33*L*H^1.5 L= Weir length= 6'

Q1 = 3.33*(L-0.2*H)*H^1.5

Weir length adjusted to account for end contractions

USED ONLY HOR HAVANAS. OUT AND HAVANA 6. OUT RUNS

= 1		_	7
Elevation (ft)	Head (ft)	Q (cfs)	Q1 (cfs)
	-		
484.00	0.00	0.00	0.00
484.50	0.50	7.06	6.95
485.00	1.00	19.98	19.31
485.50	1.50	36.71	34.87
486.00	2.00	56.51	52.74
486.50	2.50	78.98	72.40
487.00	3.00	103.82	93.44
487.50	3.50	130.83	115.56
488.00	4.00	159.84	138.53
488.50	4.50	190.73	162.12
489.00	5.00	223.38	186.15
489.50	5.50	257.71	
490.00	6.00	293.64	210.47
-	0.00	233.04	234.92

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7/30/01

Stage-Storage Relationship- Pond 3 at Havana Power Station

Stage (ft)	Storage (acre-ft)	Water surface area (acres)
•		
484.50	0.00	4.70
485.00	2.36	4.76
485.50	4.76	4.82
486.00	7.18	4.88
486.50	9.64	4.94
487.00	12.12	5.00
487.50	14.63	5.05
488.00	17.17	5.11
488.50	19.75	5.17
489.00	22.35	5.23
489.50	24.98	5.29
490.00	27.64	5.35

Normal pool elevation:

484.5'

Area at normal elevation:

4.70 acres = 204,790 sq. ft.

Max. pool elevation:

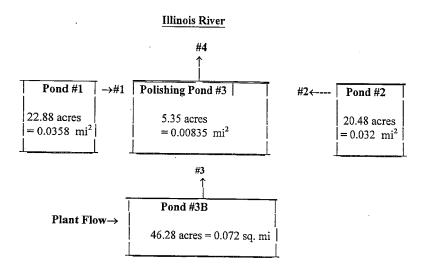
490'

Area at max. elevation:

5.35 acres = 232,886 sq. ft.



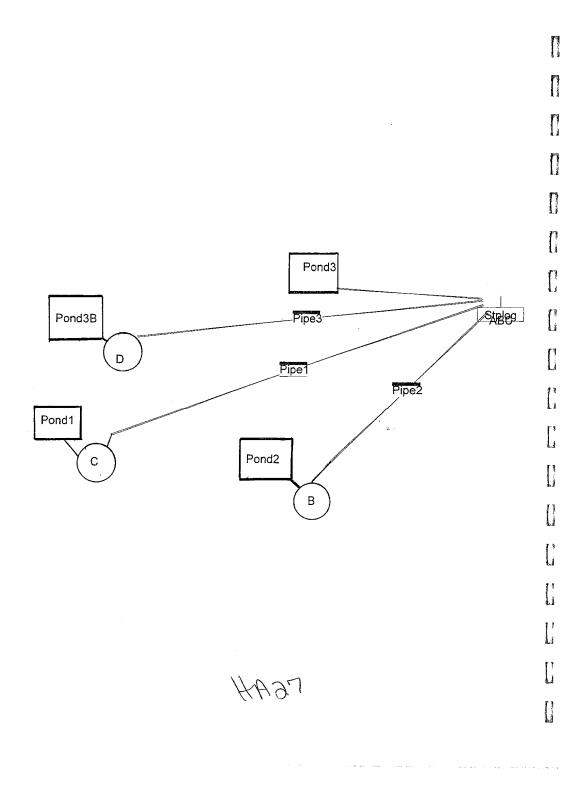
Principal Outlet Design



- #1- 30" standpipe discharging into bottom of Polishing Pond
- #2- 36" pipe between Pond #2 and Polishing Pond
- #3- 36" standpipe between Pond #3B and Polishing Pond
- #4- 6' wide stop log structure and 36" φ RCCP to Illinois River

For 24-hr. events, plant flow = 11.9 cfs (7.70 MGD)

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HE THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HYDROED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRICING HAVE CHANGED FR THE DEFINITIONS OF VARTABLES FRIME-AND FRIENDS FRIME FROM THE FRIENDS FRIME FROM THE FROM THE FRIENDS FRIME FROM THE FROM T	**************************************	XXXXX X T" - 100 4R STORM USING X X X X X WEIR DISCHARGE @ PUNDS 1,2 E.3B	C1 (JAN 73), HECIGS, HECIDB, AND HECIKW. OM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. DATED 28 SEP 81. THIS IS THE FORTEANT? VERSION CALCILATION, DSS:WRITE STAGE FREQUENCY, GREEN AND AMPT INFILTRATION	PAGE 1		0.0062 0.0073 0.0083 0.0094 0.02173 0.0196 0.0208 0.0249 0.0319 0.0322 0.0425 0.0438 0.0452 0.0466 0.0568 0.0583 0.0598 0.0614 0.073 0.0747 0.0764 0.0782	
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Havana Power Plant Dynegy Midwest Generation, Inc. Havana, IL

DRAFI

	154 155 156	157 158 159	160	162 163	164 165	166 167 168		LINE (V) R	NO. (.) C	6 Pond1	38 Pipe	44	92	82	115	121	154 ABC.	V V 157 Stplog	(***) RUNOFF ALSC
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* HYDROLOGIC ENGINEERING CENTER * 609 SECOND STREET * 1 EAVIS, CALIFORNIA 95616 * 4 (916) 551-1748 * ***********************************					化水子 化水子 化水子 化水子 化水头 化水头 化水头 计计算 计计算 化水子			The state of the s
* WAY 1991 * havanal.out * VERSION 4.0.15 * * * RUN DATE TIME * * * ******************************	5 IO OUTPUT CONTROL VARIABLES IPRNT 4 PRINT CONTROL IPLOT 0 PLOT CONTROL QSCAL 0. HYDROGRAPH PLOT SCALE	IT HYDROGRAPH TIME DATA NMIN 10 MINUTES IN COMPUTATION INTERVAL 1DATE 1JAN94 STRATING DATE ITIME 0000 STRATING DATE NQ, 160 NUMBER OF HYDROGRAPH ORDINATES NDATE 2JAN94 ENDING DATE NDATE 0230 ENDING TIME ICENT 19 CENTURY MARK	COMPUTATION INTERVAL 0.17 HOURS	ENGIISH UNITS PRECIPITATION DEPTH INCHES LENGTH, ELEVATION CUBET FEET FLOW STORAGE VOLUME STORAGE VOLUME ACRE-FEET TEMPERATURE DEGREES FAHRENHEIT	*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***	6 KK * Pondl * * * * * * * * * * * * * * * * * * *	7 KO OUTPUT CONTROL VARIABLES 1 PRINT 4 PRINT CONTROL 1 PLOT 0 PLOT CONTROL QSCAL 0. HYDGGRAPH PLOT SCALE I PUCH COMPUTED HYDGGRAPH Page 6	

	havanal.out THIS UNIT CHED OR SAVED HED OR SAVED OURS					TATION	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	* * *	UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 2. 1. 0.
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I Throate and	IOUT ISAV1 ISAV2 1	TIME DATA FOR INPUT TIME JXDATE 1JAN94 JXTIME 0	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.04	PRECIPITATION DATA	STORM 7.	INCREMENTAL PRECIPITATION 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.		60. 54. 16.
P		10 IN		8 B.A.		9 PB	11 PI 36 LS 37 UD		

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				TYPE OF INITIAL CONDITION						***							
				INITIAL	87.6	490.00	26.			* *							To the same
				YPE OF	.2		26.			* * * *							
				ELEV T	76.2	489.50	2			* * *							
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				ITYP	53.8	488.50	26.			化苯基 化苯基 使放弃 化苯基 化苯基 化苯基 化苯基 化苯基 化苯基 化苯基 化苯基 化苯基 化苯基							Total Control
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hav		I SCALE HYDROGE H ON THI PUNCHED PUNCHED		ACHES/ ION COEFFIC			26.			* * * *				r SCALE HYDROGR 1 ON THI PUNCHED PUNCHED	IN MINUT		
		PRINT CONTROL HYDROGRAPH FLOT SCALE BYDNCH COMEUTED HYDROGRAPH SAYE HYDROGRAPH ON THIS UNIT FRIST ORDINATE PUNCHED ON SAN LAST ORDINATE PUNCHED ON SAY TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	21.2	487.00	2			* * * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE BUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS I FIRST OALINATE PUNCHED OF LAST OALINATE PUNCHED OF TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		
	ပ	PRINT CONTROL HYDROGRAPH PLA HYDROGRAPH PLA BUNCH COMPUTE SAVE HYDROGRAP FIRST ORDINATE TAST ORDINATE TIME INTERVAL		UMBER O INITIAL ORKING	10.5	486.50	6			*				PRINT CONTROL PLOT CONTROL HYDROGRAPH PLI PUNCH COMPUTE SANCH CYDROGRAP ERST ORDINATA LAST ORDINATE TIME INTERVAL	SERIES TIME INTERVAL STARTING DATE STARTING TIME		
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	υ	ROL VA	DTING D			486				* * * * *				ROL VAR	R INP		E CANAL STATE
,	* * * *	OT CONTI IPRNT IPLOT QSCAL IPNCH IOUT ISAVI ISAV2	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	MION	ARGE			*	* * *	* *	* * *	OUTPUT CONTROL VARIABLES 1 PROT 0 QSCAL 0. I PNCH 1 1 IOUT 22 I SAV1 1 I ISAV1 167 I ISAV2 160 TIMINT 0.167			
	** Pipel *:	COUTPUT	HYDROGE	STOR	STC	ELEVATION	DISCHARGE			* * * * *	*******	Pond2	**********	OUTPO	TIME		
*	: * * *									* * * * *	*	* * :	* *				2
	38 KK	о 6 8		40 RS	41 SV	42 SE	43 SQ			* * *		44 KK		45 KO	48 IN		
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	har		V AREA		BASIN TOTAL PRECIPITATION	ENN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA		*	UNIT HY 7 END-OF-PE 1.	**		OT SCALE
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		SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.03	PRECIPITATION DATA	STORM	INCREMENTAL PRECIE 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.14 0.01 0.01 0.00	LOSS RATE 0.00 STRTL 0.00 CRVNBR 100.00 RTIMP 100.00	DIMENSIONLESS UNI TLAG 0.		49. 15.	***	* * * * CN2ME	OUTPUT CONTROL VARIABLES 1 PRAT 0 0 QSCAL 0. I PNCH 0
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The second secon			46 BA		47 PB	면 6	74 LS	75 UD.			***	76 KK	77 KO

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		NOILION					* * * * * * * * * * * * * * * * * * * *								
		TYPE OF INITIAL CONDITION	79.7	58.	490.00		*								
		YPE OF II					* * *								
		ELEV T	69.6	58.	489.50		* * * *								
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havanal.out SAVE HYDROGRAP ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		CIENT	29.4	58.	487.50	* *	* * * *			PRINT CONTROL HYDROGRAPH PLOT SCALE FUNCH COMPUTED HYDROGRAPH FUNCH COMPUTED HYDROGRAPH FINST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	TES			SION Page 10	
ha PH ON TH PUNCHE PUNCHED		EACHES/ TION D COEFFI	19.5	58.	487.00 4		* * *			OT SCALE D HYDROG PH ON TH E PUNCHED PUNCHED	IN MINU			OW RECESS	TAX: :SMI
SAVE HYDROGRAPH ON THII FIRST ORDINATE PUNCHED LAST ORDINATE PUNCHED (TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT					* * *		puod y	PRINT CONTROL HYDROGRAPH PLOT SCALE FONCH COMPUTED HYDROGRAPH SANE HYDROGRAPH SANE HYDROGRAPH TIRST ORDINATE PUNCHED OR SAN LAST ORDINATE PUNCHED OR SAN TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA	INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT Page	
_	-	1 NUMBER 0 INITI 0 WORKIN	7.6	31.	486.50		* * * *		New proposed ash pond		ME SERIES 6 TIME II 14 STARTII 0 STARTII			ICS 0 INITI 0 BEGIN 0 RECES	ALL AND ADDRESS OF THE PARTY OF
22 1 160 0.167	ING DATA		0.0	11.	486.00		* * * * *		New pro	. VARIABLE: 4 4 0.0.	INPUT TIMI 6 1JAN94 0	DATA	CTERISTICS 0.07	ACTERISTICS 11.90 0.00 1.00000	
IOUT ISAV1 ISAV2 TIMINT	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ARGE	TION		* * * *	* * *	* * * * * m *	OUTPOT CONTROL VARIABLES IPROT 0 QSCAL 0.1 IPNCH 1.1 IOUT 2.2 ISAV1 1.60 ISAV2 160 TIMINT 0.167	TIME DATA FOR INPUT TIME JXMIN 6 5 JXNATE 1JAN94 0	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.07	FLOW CHARACTERISTICS STRTQ 11.90 QRCSN 0.00 RTIOR 1.00000	
	HYDROGR	STORA	STO	DISCHARGE	ELEVATION		* * * * * *	*****	* PONG3B * * ********	Ourpo	TIME	SUBBASI	SUBBA	BASE	
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			BASIN TOTAL PRECIPITATION	ERRN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UNI 7 END-0 3.	* **			PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH NNT SANTE HYDROGRAPH ON THIS UNI FIRST ORDINATE PUNCHED OR SAVED IAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	
				TION PAIT 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0		raph Lag		10.	* * *		Ω	PRINT CONTROL PLOT CONFOL PLOT CONFOL PROCEDED PINE PUNCH COMPUTEI SAVE HYDROGRA IENST ORDINATI LAST ORDINATI LAST ORDINATI	
An internation		DATA	7.00	L PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 100.00 100.00	UNITGE 0.15		33.	* * * *		CNAME	OUTPUT CONTROL VARIABLES IPRNT 0 GENCH 0 IRNCH 0 INNCH 22 ISAVI 11 ISAVI 160 TIMINT 0.167	
		PRECIPITATION DATA	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG		109.	* * * *	* *	* * * * *	IPRNT IPRNT IPLOT OSCAL IPNCH IOUT ISAV1 ISAV2	
		PRECI		ON	SCS L	SCS D		122.	* * * * *	*****	* * * * * * * * * * * * * * * * * * *	OUTPUI	
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TYPE OF INITIAL CONDITION					* * * * * * * * * * * * * * * * * * * *												
INITIAL	181.1	496.00	58.		***												T
TYPE OF	158.0	495.50	58.		* * *												li
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Q.	135.1	495.00	58.		* * *												The state of the s
ITYP	112.3	494.50	58.		* * * *	,											
	9.68	494.00	58.		* * *												
ř.,					***				PRINT CONTROL HYDROGRAPH PLOT SCRIED FUNCH COMFUTED HYDROGRAPH STRE HYDROGRAPH OF HIS UNIT FIRST ORDINATE PUNCHED OR SAVED THAE INTERNAL IN HOURS						BASIN TOTAL PRECIPITATION	12	
1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	67.0	493.50	58	*						INUTES			ECESSION			Page 12	
NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFE	44.5	493.00	31.		有原本 有原本 水黄素 医水黄 医水黄				PRINT CONTROL HYDROGRAPH PLOT SCALLE PUNCH COMPUTED HYDROGRA PUNCH COMPUTED HYDROGRA FINST GROINARE PUNCHED LAST ORDINATE PUNCHED TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		REA	S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		AL PRECI		
UMBER OF SUBREACH! INITIAL CONDITION PORKING R AND D COI	22.2	492.50	11.		* * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH PL PRONCH COMPUTE SAVE TYPROGRAP FIRST ORDINAT LAST ORDINAT TIME INTERVAL	SERIES TIME INTERVAL STARTING DATE STARTING TIME		SUBBASIN AREA	ITIAL FI SIN BASE CESSION		SIN TOT		
1 NUMB 00 INI 00 WORK													STICS .00 IN: .00 BE		7.00 BA		
	0.0	492.00			* * * * * * * * * * * * * * * * * * * *				L VARIAL	INPUT TIME 6 6 1JAN94 0	DATA	ACTERIS	RACTERISTIC: 0.00 0.00 1.00000	DATA	7		
STORAGE ROUTING NSTPS RSVRIC X	AGE	noi	RGE		*	* *	* *	* *	OUTPUT CONTROL VARIABLES 1 PROT 0 QSCAL 0 1 PROT 0 1 ENCH 1 1 ISAV1 1 1 ISAV2 160 TIMINT 0.167	TIME DATA FOR INPUT TIME 6 JXMIN 6 JXDATE 1JAN94 UXTIME 0	RUNOFF	SUBBASIN CHARACTERISTICS TAREA, 0.01	FLOW CHARACTERISTICS STRTO 0.00 QRCSN 0.00 RTIOR 1.00000	PRECIPITATION DATA	STORM		
STORAG	STORAGE	ELEVATION	DISCHARGE		* * * *	*****	Pond3	* *****	OUTPUT	TIME	SUBBASIN RUNOFF DATA	SUBBAS	3248 1	PRECI			
					* * * *	*	* *	* *									And the second
117 RS	118 SV	119 SE	120 SQ		* * * * * * * * * * * * * * * * * * * *		121 KK		122 KO	126 IN		123 BA	124 BF		125 PB		
					*												L
									HA39								



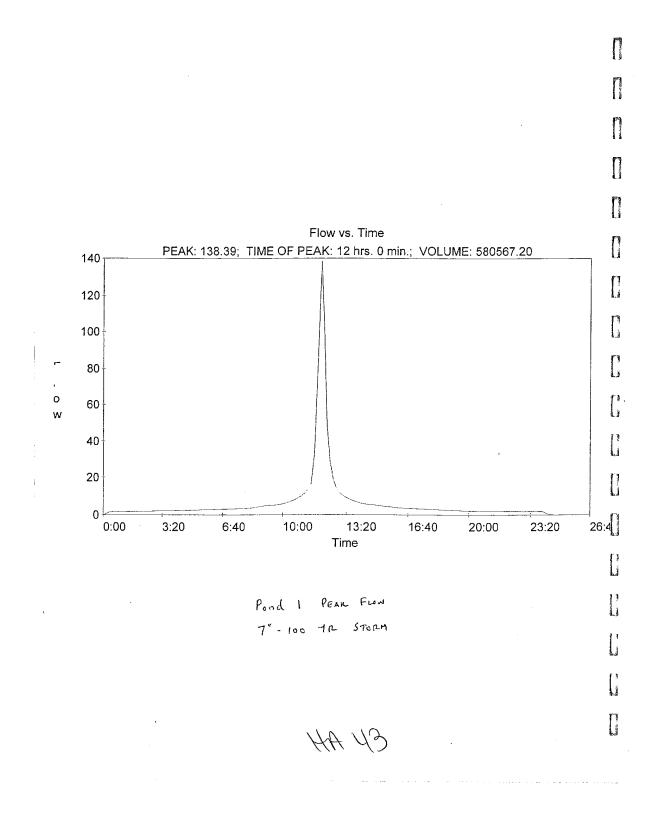
157 KK	* * * * * * * * * * * * * * * * * * *	CNAME	ABC								
158 KO	OUTPUT CONTR IPLOT QSCAL IPNCH IOUT ISAVI ISAVI ISAVI	CONTROL VARIABLES PRNT 0 SPLOT 0. SIGOL 0. IOUT 22 SAV2 16 MINT 0.167		PAINT CONTROL PLOT CONTROL PLOT CONTROL PROGRAPH = ELOT SCALE PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT ETST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	LLE CGRAPH THIS UNIT HED OR SAVE URS	Q Q					
	HYDROGRAPH ROUTING	TING DATA									
159 RS	STORAGE ROUTING NSTPS RSVRIC X	1 484.00 0.00	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	SUBREACHES CONDITION AND D COEF	/ FICIENT		TYP		ELEV TYPE C	TYPE OF INITIAL CONDITION	CONDI
160 sv	STORAGE	0.0	0.0	27.6	4.8	7.2	9.6	12.1	14.6	17.2	19.7
162 SE	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
164 SQ	DISCHARGE	0. 223.	7. 258.	20.	37.	56.	.9.	104.	131.	160.	191.
166 SE	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
					* *						
	STORAGE 0.00 OUTLOW 0.00 ELEVATION 484.00	0 0.00 0 7.06 0 484.50	2.36 20.00 485.00	COMPUTED STORAGE-CONFLOW-ELENATION DATA 2.36 4.76 7.18 9.64 20.00 36.70 56.50 79.00 85.00 486.50 486.50	-OUTFLOW-E 7.18 56.50 486.00	LEVATION D 9.64 79.00 486,50	12.12 103.80 487.00	14.63 130.80 487.50	17.17 159.80 488.00	19.75 190.70	
_	STORAGE 22.35 OUTFLOW 223.40 ELEVATION 489.00	5 24.98 0 257.70 0 489.50	27.64 293.60 490.00								
			FLOW TIME IN	RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND IS IN HOURS, AREA IN SQUARE M: Page 14	OFF SUMMAR IC FEET PE AREA IN Page 14	FF SUMMARY FEET PER SECOND AREA IN SQUARE MILES Page 14	ន្ទ				

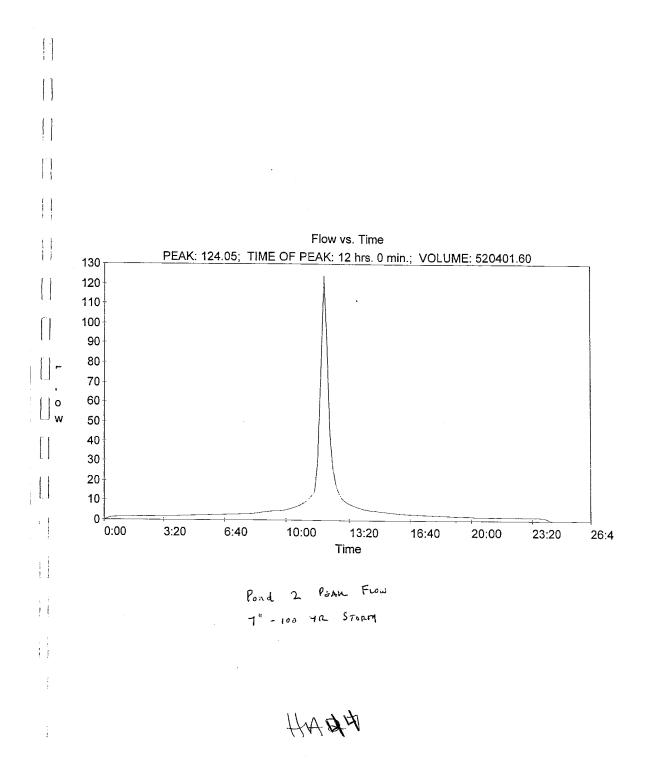
havanal.out

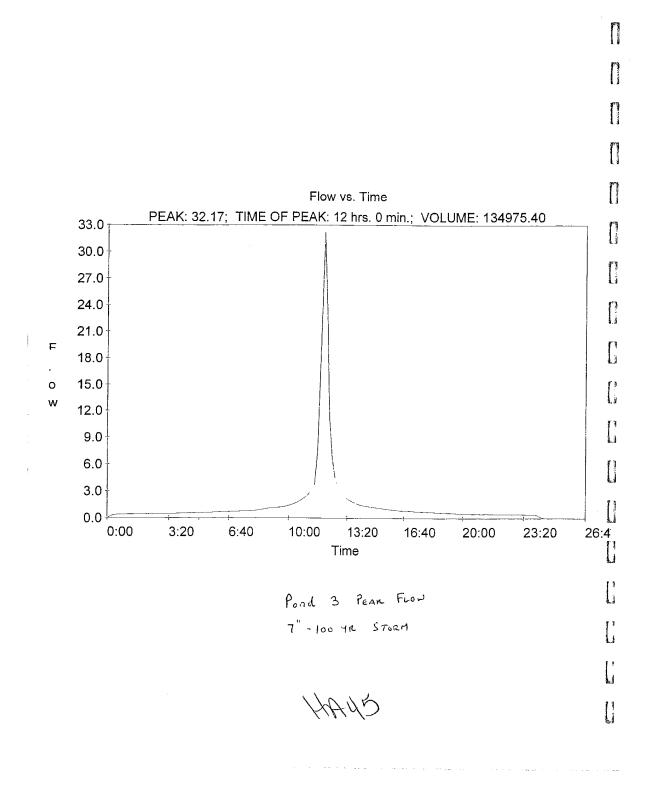
		TIME OF	MAX STAGE		13.67		6	0 . 22	12,50			15.17
		MAXIMUM	STAGE		486.41	:	40 6		492, 68			485.63
		BASIN	AKEA	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15
		M PERIOD	72-HOUR	ó.	4.	5.	12.	24.	11.	;	29.	27.
	out	FOR MAXIMU	24-HOUR	7.	4	ė.	12.	25.	12.	.5	30.	28.
	havanal.out	AVERAGE FLOW FOR MAXIMUM PERIOD	6-HOUR	19.	7.	17.	15.	50.	18.	4.	43.	40.
		TIME OF	NEG 3	12.00	13.67	12.00	12.67	12.00	17.50	12.00	12.00	15.17
		PEAK		138.	œ	124,	19.	291.	18.	32.	62.	42.
		NOTHERS		Pond1	Pipe1	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog
and the second s		NOTERRE		HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO

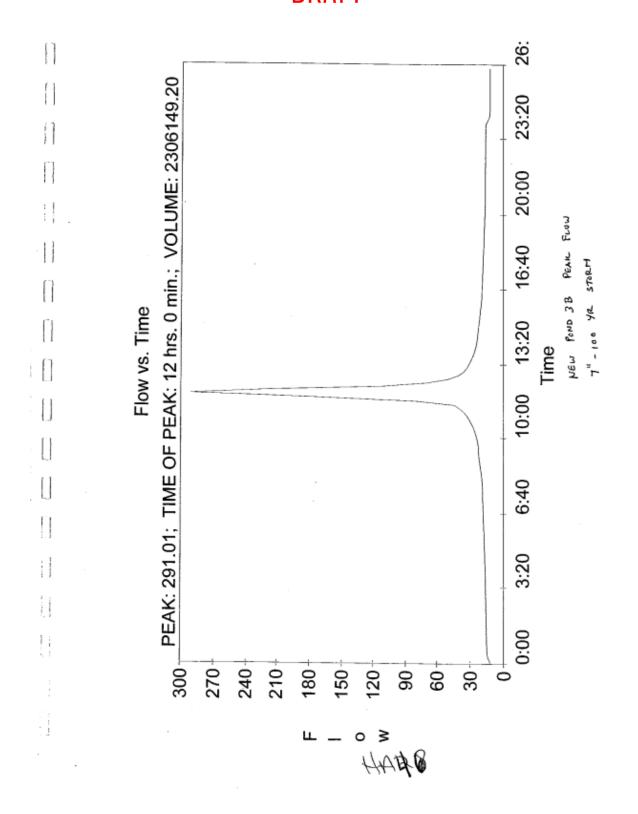
* NORMAL END OF HEC-1 ***

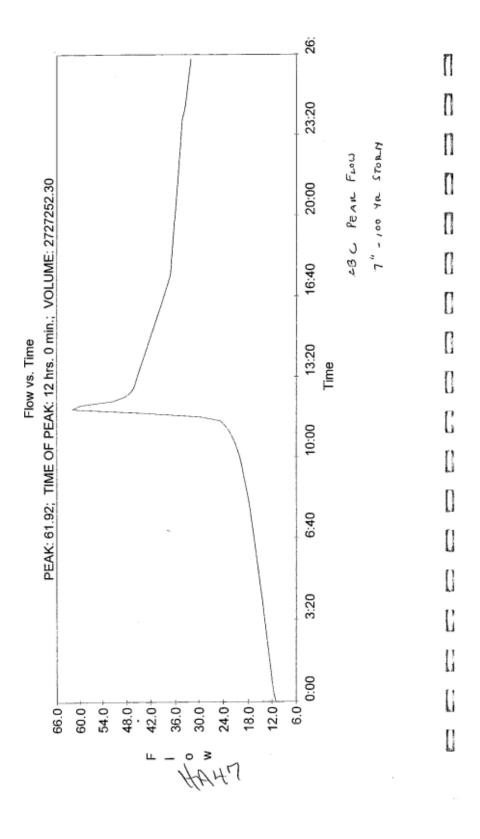
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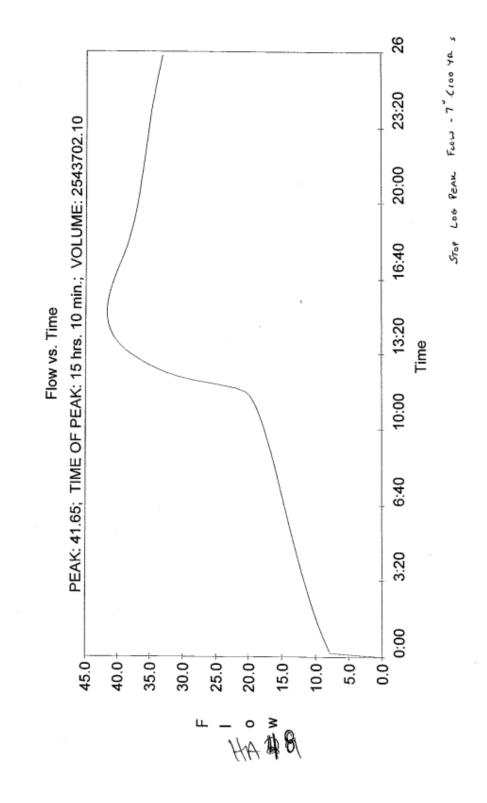












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U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 [916] 551-1748	Serre	STRUCTURE.					
ANY CORPS OF ENGINEERING 609 SERVENG 609 STREET 178. CALIFORNIA 95 (916) 551-1748	Stopin se C	ECIRM. INPUT ST AM77 VER EMCY,	PAGE 1				
ARMY CORPS OF ENGINEER ROLOGIC ENGINEERING CERF 609 SECOND STREET CONTS. CALFORNIA 95616 (916) 551-1748	loo ya St Discmarce	B, AND HECHEN 3-STYLE INPUT HE FORTHANT? GE FREQUENCY,	10			0.0094 0.0208 0.0332 0.0466 0.0614	0
HYDB	001 -	IS, HECIDB, THE 1973- HIS IS THE RRITE STAGE FRITERATION				0.0083 0.0196 0.0319 0.0452 0.0598	1
*******	7	USEO WITH THE 1973-STYLE INPUT STRUCT USEO WITH THE 1973-STYLE INPUT STRUCT SEP 01. "HIS IS THE FORTUNNTY VERSION COM, DES:WRITE STRUCK FREQUENCY,	80			0.0073 0.0185 0.0307 0.0438 0.0583	[]
	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	1 (JAN 73), M THOSE USE ATED 29 SEP ALCULATION, GREEN AND A	7			0.0062 0.0173 0.0294 0.0425 0.0568	
out	XXXXXX X	N AS REC1 NGED FROM ISIONS DAY ONANGE CAI	w			0.0051 0.0161 0.0281 0.0411 0.0553	С
havana2.out	X X X X X	OF HEC-1 KNONN AS TIOR- HAVE CHANGED HIGHD WITH RIVISION SINGLE EVENT DAMAGE INTERVAL LOSS BE	INPUT		74	0.0041 0.015 0.0269 0.0398 0.0696	r
		NS OF HE -RTIOR- CHANGED ON INTER	HEC-1 INPUT	160	1	0.0031 0.0138 0.0257 0.0384 0.0523	li Fi
	******	S VERSIONS AP- AND -R' ARD MAS CH MENGENCE, ENCE ALGOR	3	0	0 0	0.002 0.0127 0.0244 0.0371 0.0508	T)
1		PROGRAM REPLACES ALL PREVIOUS DEFINITIONS OF VARIABLES - FITIM PRICHES: DAMBREAK ON THE SEND SPEND READ TINE SERIES AT DESIRED CAL BATIC WAVE: NEW FIRST DIFFERE	2	1JAN94	0 1JAN94	0.001 0.0116 0.0338 0.0358 0.0494	Li
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	havana2.out	L LOT SCALE	MINUTES IN COMPUTATION INTERVAL STARTING DATE STARTING TIME NUMBER OF HYDROGRAPH ORDINATES ENDING TANE CENTURY NARK	QNO		7 SCALE NYDROGRAPH Page 6
		OUTPUT COBTROL VARIABLES FRINT CONTROL FRANT 4 FRINT CONTROL FRANT 0 PLOT CONTROL GSCAL 0 HYDROGRAPH PLOT SCALE	0400400	COMPUTATION INTERVAL 0.17 HOURS TOTAL TIME BASE 26.50 HOURS NITS NAME AREA PUTATION DEPTH INCHES TH, ELEVATION FEET TH, ELEVATION ACRE-FEET ACRE AREA DEGREES FAHRENHEIT	***	OUTPUT CONTROL VARIABLES IPENT 0 FAINT CONTROL IPLOT 0 FAINT CONTROL QUELL 0. NYDROGRAPH PLOP SCALE IFNCH 1 PUNCH COMPUTED NYDROGRAPH PAGE
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100T 22 SAVE HYDROGRAPH ON THIS UNIT 1SAVI 1 FIRST ORDINATE PUNCHED OR SAVED 1SAV2 160 LAST ORDINATE PURCHED OR SAVED TIMINT 0.167 TIME INTERVAL IN HOURS	TIME DATA FOR INDUT TIME SERIES JXDATE 1JAN94 STARTING DATE JXTIME 0 STARTING TIME	SUBBASIN RUNCEF DATA	SUBBASIN CHARACTERISTICS 0.04 SUBBASIN AREA	PRECIPITATION DATA	STORM 7.00 BASIN TOTAL PRECIPITATION	INCREMENTAL PRECIPITATION PATTERN 0.00	SCS LOSS RATE 0.00 INITIAL ABSTRACTION CRYNER 100.00 CORVE NUMBER ATTEMPTORY ATTEMPT 100.00 PERCENT INPERVIOUS AREA	SCS DIMENSIONLESS UNITGRAPH TLAG 0.15 LAG	UNIT HYDROGRAPH 7 END-OF-FERIOD ORDINATES 2. 2. 16. 5. 2. 1. 0.	*** ***	Page 7	
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t;		Q			42.8	488.00	74.		* * * * *		-				
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		PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UP THEST CROINATE PUNCHED OR LAST ORDINATE PUNCHED OR TIME INTERVAL IN HOORS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	21.2	487.00	26.		* *					PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UI ETERST ORDINATE PUNCHED OR LAST ORDINATE PUNCHED OR THME INTERVAL IN HOURS	SERIES TYME INTERVAL IN MINUTES STARTING DATE STARTING TIME
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hav		BASIN TOTAL PRECIPITATION		INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UNIT H END-OF-P 3.	* * * * * * * * * * * * * * * * * * * *			T SCALE HYDROGRY H ON THI PUNCHED IN HOURS	Δi	
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119 SE	ELEVATION	492.00	492,50	493.00	493.50	494.00	494 50	1.001	706.00	181.1	
120 SQ	DISCHARGE	.0	11.	31.	58.	89.	124.	153.	205.	251.	
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126 IN	TIME DATA FOR JAMIN JADATE JATIME	DATA FOR INPUT TIME JXMIN 6 JXDATE 1JAN94 JXTIME 0		SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME	NUTES						
	SUBBASIN RUNOFF DATA	DATA									
123 BA	SUBBASIN CHARACTERISTICS TAREA, 0.01		SUBBASIN AREA	area							
124 BF	BASE FLOW CHARY STRTQ QRCSN RTIOR	FLOW CHARACTERISTICS STRTQ 0.00 QRCSN 0.00 RTIOR 1.00000	INITIAL FLOW BEGIN BASE E RECESSION CO	; INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT	ESSION						
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125 PB	STORM	7.00	BASIN TOTA	BASIN TOTAL PRECIPITATION	TATION						
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hav		INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			UNIT H END-OF-P 0.	* * *			PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE FONCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVE LAST ORDINATE INTERVAL IN HOURS	OGRAPHS	ů,	j
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		* * * * * * * * * * * * * * * * * * * *					CONDITION	19.7	488.50	191.	488.50					
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	ut	* * * * *			/ED			7.2	486.00	56.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	9.64 79.00 486.50		F SUMMARY : FEET PER SECOND AREA IN SQUARE MILES Page 14
	havana2.out	*** *** ***			ALE ACGRAPH THIS UNIT THED OR SAVI		s/ FICIENT	4.8	485.50	37.	485.50	* *	-OUTFLOW-E	7,18 56.50 486.00		OFF SUMMAR IC FEET PE AREA IN Page 14
		*			PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH ELAST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TINE INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	2.4	485.00	20.	485.00		ED STORAGE	4.76 36.70 485.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MI Page 14
		***		ABC			NUMBER OF INITIAL C WORKING R	0.0	484.50 489.50	7.	484.50		COMPUT	2.36 20.00 485.00	27.64 293.60 490.00	e Time
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		*** *** *** ***	****	* Stplog * * * * * * * * * * * * * * * * * * *	OUT	HYDROC	STOF	S1	BLEV	DISC	BLEV			STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
		* * *		157 KK	158 KO		159 RS	160 SV	162 SE	164 SQ	166 SE					



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@ POLISHING POM Pous 1,2 E.3 U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEBRING CENTER 609 SECOND STREET DAVIS, CALIFORNIA 95616 (916) 551-1748 THE DEFINITIONS OF VARIABLES -RTIME- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF "AMBKEA" ON RM-CARD MAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN'T VERSION NEW OFTIONS: DAMBREAR OUTFLOW SUBMERGENCE, SINCLE EVENT DAMAGE CALCULATION, DSS.WRITE STACE FREQUENCY, DSS.RAID TIME SERIES AT DESIRED ALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILITRATION () Discharge 0.5 PMP ULING GL THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HECI (JAN 73), HEC1GS, HEC1DB, AND HEC1KM 0.0094 0.0208 0.0332 0.0466 0.0614 Weir 0.0062 0.0173 0.0294 0.0425 0.0568 0.0051 0.0161 0.0261 0.0411 0.0553 0.0041 0.015 0.0269 0.0398 0.0538 0.0696 22 HEC-1 INPUT 160 0.0031 0.0138 0.0257 0.0384 0.0523 ×××××× ××××××× 0 0.001 0.0116 0.0232 0.0358 0.0494 1JAN94 ******************************** KK Pondl

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* HYDROLOGIC ENGINEERING CENTER * * DATS, CALIFORNIA 95616 * * (916) 551-1748 * * *			*** *** *** *** *** *** *** *** *** **	
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46 BA	SUBBASIN RUNOFF DATA	DATA			Havana3.out	out					
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SAVE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		UBREACHES/ NOITION NO COEFFICIENT	19.5 29.4 39.3 49.3 59.4 69.6 79.7	. 85	489.50 490	计分类 化二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二甲基二			PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE BUNGH CORPUTED HYDROGRAPH SINE HYDROGRAPH ON THIS UNIT EIRST ORDINATE PUNCHED OR SAVED TAME INTERVAL IN HOURS	SERIES TIMB INTERVAL IN MINUTES STARTING DATE STARTING TIME		6.3	S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT Page 10	
22 SAVE HYDRO 1 FIRST ORDI 160 LAST ORDIN 0.167 TIME INTER	G DATA	1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	7.6 0.0	11. 31.	486.00 486.50	*** *** ***		New proposed ash pond			TA	ERISTICS 0.07 SUBBASIN AREA	TTERISTICS 11.90 INITIAL FLO 0.00 BEGIN BASE 1.00000 RECESSION C	
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	N DATA	16.00	L PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01	0.00 100.00 100.00	NLESS UNITGRAPH 0.15 LAG		33.	** ** ** **		CNAME		
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1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT		0 493.50		*	* * * *			PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE BANCH COMPUTED HYDROGRAPH GAVE HYDROGRAPH ON THIS UNIT FIST ORDINATE PUNCHED OR SAVEL LAST ORDINATE PUNCHED OR SAVE TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME			INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	Pa	
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HYDROGRAPH ROUTING DATA

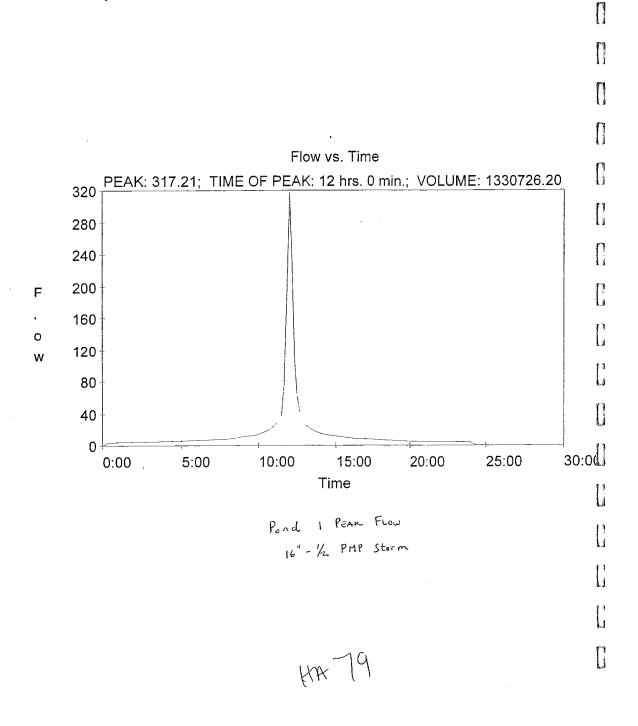
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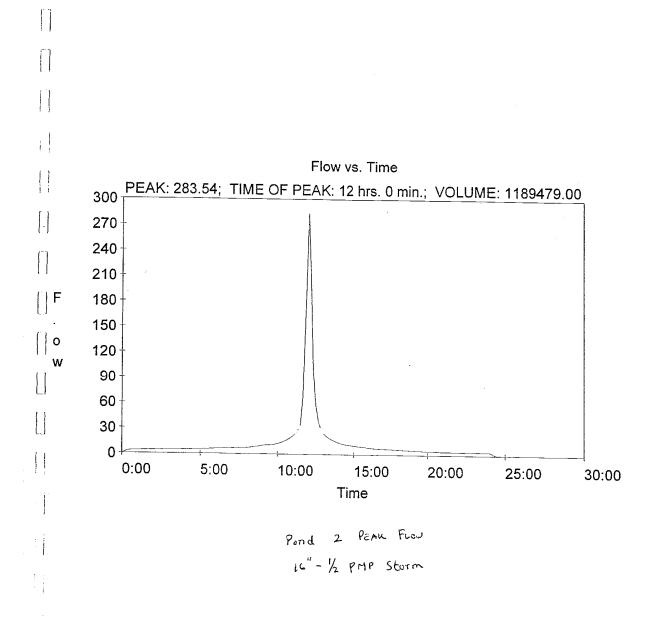
HAGB

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160 SV	STO	STORAGE	0.0	0.0	2.4	4.8	7.2	9.5	12.1	14.6	17.2	19.7
162 SE	ELEVATION	NOIT	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
164 SQ	DISCHARGE	PRGE	0.	7.	20.	37.	56.	79.	104.	131.	160.	191.
166 SE	ELEVATION	TION	484.00 489.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
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				COMPUT	TED STORAGI	COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	SLEVATION D	ATA				
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C	STORAGE OUTFLOW ELEVATION	22.35 223.40 489.00	24.98 257.70 489.50	27.64 293.60 490.00								
7				I TIME	RUNO FLOW IN CUBI TIME IN HOURS,	щ О	F SUMMARY FEET PER SECOND AREA IN SQUARE MILES Page 14	ស ធា				

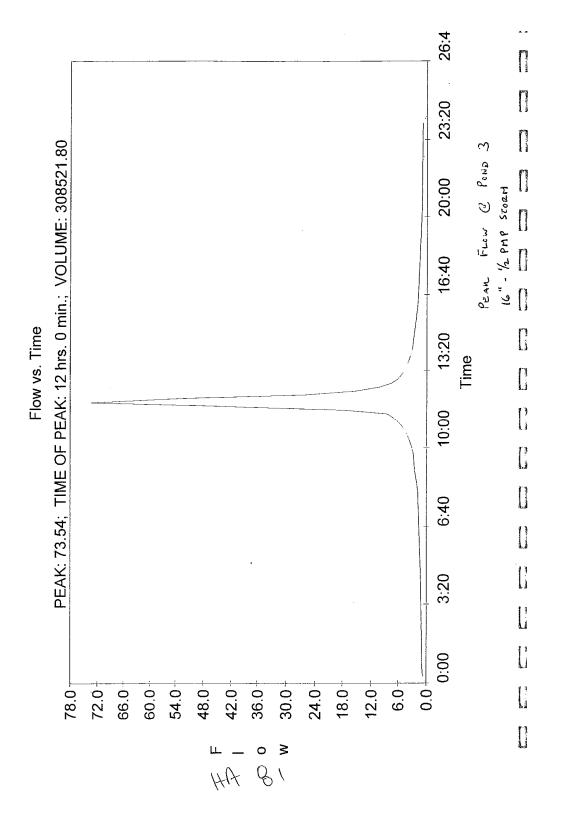
Havana3.out	PEAK TIME OF AVERAGE FLOW FOR MAXIMUM PERIOD BASIN MAXIMUM TIME OF	6-HOUR 24-HOUR 72-HOUR STAGE	Pond1 317, 12.00 44, 15, 14, 0.04	0.04	486.92 13.17 Pond2 284. 12.00 39. 14. 12. 0.03	0.03	486.57 12.67 Pond3B 650. 12.00 99. 43. 40. 0.07	22. 0.07	493.17 14.17 Pond3 74. 12.00 10. 4. 3. 0.01	ABC 131. 12.00 95. 54. 50. 0.15	Stplog 93, 15.00 87. 51, 47, 0.15 486.78 15.00
	PEAK FLOW		317.	23.	284.	35.	650.	40.	74.	131.	93.
	OPERATION STATI		HYDROGRAPH AT Pon	ROUTED TO Pip	HYDROGRAPH AT Pon	ROUTED TO Pip	HYDROGRAPH AT Pond	ROUTED TO Pipe	HYDROGRAPH AT Pond	4 COMBINED AT AB	ROUTED TO Stplo

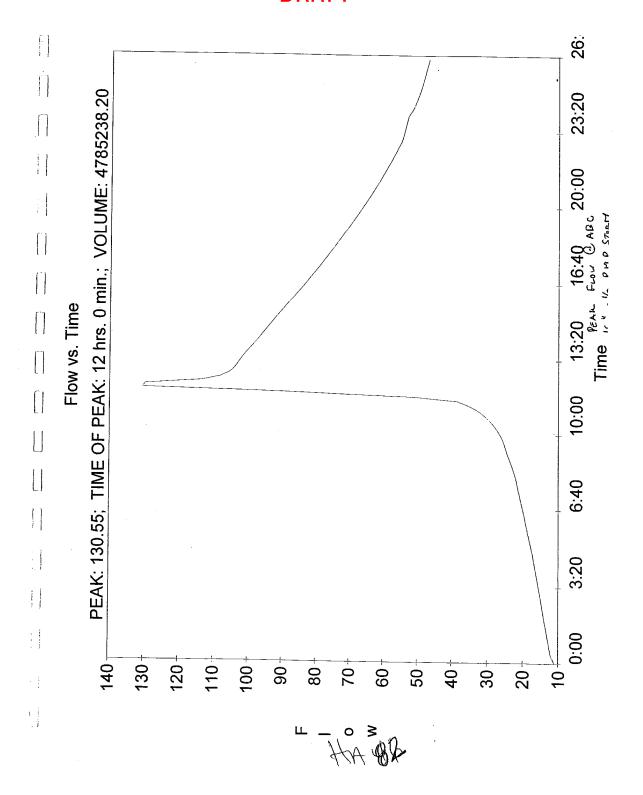
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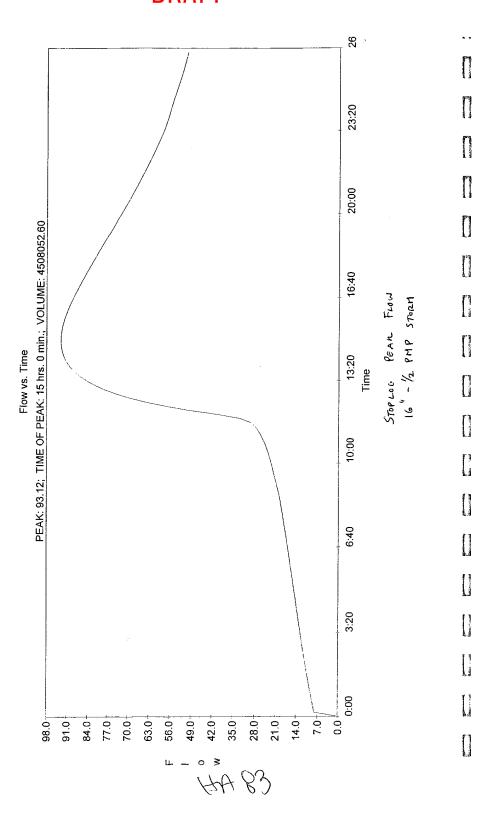


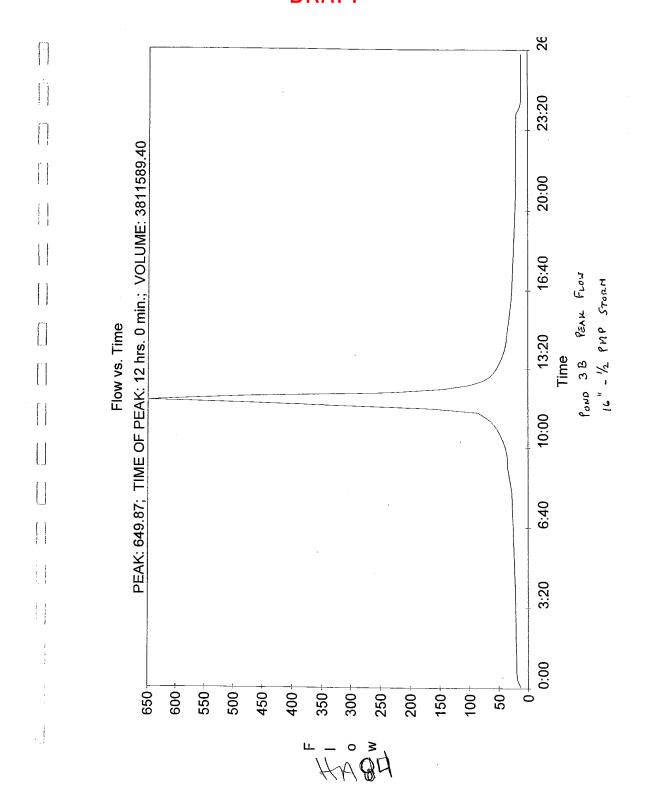












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11 PC 0.001 0.002 0.0031 0.0041 0.0052 0.0073 0.0093 0.0094 12 PC 0.0105 0.0116 0.0127 0.0138 0.015 0.0151 0.0173 0.0185 0.0196 0.0208 13 PC 0.022 0.0232 0.0232 0.0257 0.0269 0.0281 0.0294 0.0377 0.0319 0.0332 14 PC 0.0345 0.0371 0.0384 0.0371 0.0384 0.0311 0.0455 0.0466	KK Pendl KO 0 0 1 22 BA 0.0358 BA 0.0358 PB 16 IN 6 1JAN94 0 * precipl	THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1GB, AND HEC1KW.	* * * * * * * * * * * * * * * * * * * *	**************************************
KK Pondl KO 0 0 0 1 BA 0.0358 PB 16 IN 6 1JAN94 0		THE DEFINITIONS OF VARIABLES -RTINE- AND -RTIOR- HAVE CHANGED FROM THOSE USER THE DEFINITION OF AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP NEW OPTIONS: DAMBEAM OUTELOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AR KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM HEC-1 INPUT LINE	X X XXXXXX XXXXX XXXX XXXX X X X X X X	THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HECH CALUATION, DSS. RRAD THE ENGURANGE CALCULATION SHAPE CALCULATION, DSS. RRAD THE PROGRAM STREAM SHAPE LAND CALCULATION, DSS. RRAD THE PROGRAM STREAM SHAPE LAND CALCULATION, DSS. RRAD THE PROGRAM STREAM
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	PAGE OF TANTON PATTERN 0.00 CO.00 CO		RAPH LAG		1.	* * *	Stplog		NUMBER C		
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ř	i	11	\$1			* *	154	ស ភ	156		li
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Property in the Control of the Contr															
		* * * *				CONDITION	19.7	488.50	191.	488.50					
		计电极 植果花 化苯酚 化苯酚 拉林的 化香料 化树脂 化树脂 经收款 医脊髓 医阴茎 医阴茎 医皮肤 化环烷 化丁二二丁二二二丁二二丁二二丁二丁二丁二丁二丁二丁二丁二丁二丁二丁二丁二丁二丁				TYPE OF INITIAL CONDITION	17.2	488.00	160.	488.00			19.75 190.70 488.50		
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	:	*				ELEV	12.1	487.00	104.	487.00			14.63 130.80 487.50		
		* * * * * * * * * * * * * * * * * * *				ITYP	9.6	486.50	79.	486.50		лта	12.12 103.80 487.00		δί
	#	* * * * * * * * * * * * * * * * * * *		g g			7.2	486.00	56.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	9,64 79.00 486.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREB. IN SQUARE MILES Page 14
	Havana4.out	k k k		LLE COGRAPH THIS UNIT HED OR SAVE		/ FICIENT	4.8	485.50	37.	485.50	*	-ourerow-e	7.18 56.50 486.00		DEF SUMMARY C FEET PEF AREA.IN S PAGE 14
	;			TTROL IROL HROL HPLOT SCA HPUTED HYDR COGRAPH ON INATE PUNCH INATE PUNCH		SUBREACHES ONDITION AND D COEF	2.4	485.00 490.00	20.	485.00		ED STORAGE-	4.76 36.70 485.50		RUNC LOW IN CUBI IN HOURS,
	+ + + + + + + + +		ABC	PRINT CONTROL PLOT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SAVE PHYDROGRAPH ON SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICIENT	0.0	484.50 489.50	7. 258.	484.50 489.50		COMPUT	2.36 20.00 485.00	27.64 293.60 490.00	FI
	***		CNAME	L VARIABLES 0 0.0 2.2 12 160	NG DATA	1 484.00 0.00	0.0	484.00	223.	484.00 489.00			0.00 7.06 484.50	24.98 257.70 489.50	
	***************************************		* * * * * * * * * * * * * * * * * * * *	OUTPUT CONTROL VARIABLES IPRNT 0 0 SCAL 0. IPNCH 0. 100T 22 ISAV1 1 ISAV2 160 TIMINT 0.167	HYDROGRAPH ROUTING	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	ELEVATION			0.00 0.00 484.00	22.35 223.40 489.00	
. Limber	***************************************	****	* Stplog * * * * * * * * * * * * * * * * * * *	ŪDO .	HYDROG	STOR	S	BLEV	DISC	ELEV			STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
	**		157 KK	158 КО		159 RS	160 sv	162 SE	164 SQ	166 SE			ធ		
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					Havana4.out	4.out					
			PEAK	TIME OF	AVERAGE FL	AVERAGE FLOW FOR MAXIMUM PERIOD	UM PERIOD	BASIN	MAXIMUM	TIME OF MAX STAGE	
	OPERATION	STATION		PEAK	6-HOUR	24-HOUR	72-HOUR				
	нуркоскарн ат	Pond1	317.	12.00	44.	15.	14.	0.04			
	ROUTED TO	Pipel	23.	13.17	21.	11.	10.	0.04	486.92	13.17	
	HYDROGRAPH AT	Pond2	284.	12.00	39.	14.	12.	0.03			
	ROUTED TO	Pipe2	35.	12.67	28.	16.	16.	0.03	486.57	12.67	
	HYDROGRAPH AT	Pond3B	650.	12.00	. 66	43.	40.	0.07			
	ROUTED TO	Pipe3	40.	14.17	39.	24.	22.	0.07	493.17	14.17	
	HYDROGRAPH AT	Pond3	74.	12.00	10.	4.	m	0.01			
	4 COMBINED AT	ABC	131.	12.00	95.	54.	50.	0.15			
	ROUTED TO	Stplog	93.	15.00	87.	51.	47.	0.15	486.79	15.00	
***	*** NORMAL END OF HEC-1 ***	* * *									

1,2838 @ Pelisting Pond Pond U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEBRING CENTER 609 SECOND STREET DAUS, CALIFORNIA 95616 (916) 551-1748 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INDUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION USE OFFICINS: DAMBRARA COUFFACING SUBMACECANCY, DAMAGE CALCULATION, DASS'RRITE STAGE FREQUENCY, DOSS:RRAD TIME SERIES AT DESIRED CALCULATION IMPERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE; NEW FINITE DIFFERENCE ALCORTHM (D) ব THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HECI (JAN 73), HECIGS, HECIDB, AND HECIKW DISCHARGE Js. 76 PMP મં હોય 0.5 × × × × × × × × 0.0051 0.0161 0.0281 0.0411 0.0553 Havana5.out 22 XXXXX XXXXX HEC-1 INPUT 160 0 1JAN94 (HEC-1) 0.0358 10 0.0105 0.022 0.0345 0.048 0.063 FLOOD HYDROGRAPH PACKAGE MAY 1991 VERSION 4.0.1E HARO

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000	0.1156	0.1408	0.2214	0.4308	0.8122	0.8474	0.8753	10.00	0.9346	0.9494	0.9622	0.9/46	0.9978							87.62	490	2. V	26.2		•							5000	0.0196	0.0319	0.0452	0.0598	0.0764	0.095	0.1156	0.1408	0.1733	0.4308	0.7588	0.8122		
1500 0	0.1135	0.1379	0.2152	0.3544	0.808	0.8442	0.8728	0.0000	0.933	0.948	0.961	0.9734	0.9967	1						76.24			26.2		c							0.0073	0.0185	0.0307	0.0438	0.0583	0.0747	0.0931	0.1135	0.1379	0.169/	0.3544	0.7514	0,808		
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0.9685 0.9806 0.9922	00	96.99	493.5	57.66	7			0138	0384	.0523	.0855	1271			HEC-1	4	0.789 0.8308 0.8522 0.9378 0.9578 0.9559 0.9685 0.9685	
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0.966 0.9782 0.9899 1	CNAME 0 ELEV	22.2	492.5	11.1	0	0	1JAN94	0.001	0.0358	0.0494	0.0818	0.1223	0.1851	0.682		2	0.778 0.8237 0.8585 0.9038 0.9333 0.9533 0.966 0.9869	
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			17.17 19.75	488 488.5	138.53 162.12	488 488.5															***************************************
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	0	00	4.76	485.5	34.87	485.5		UMP FLOW	RTED OR												
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								LINE	NO.	· ·	38	44	76	.	82	115	121	154		157	RUNOF

Dam Assessment Report

#Avana5.out # HYDROLOGIC ENGINEERING CENTER * # 609 SCOND STREET * # DAVIS, CALIFORNIA 95616 * # (916) 551-1748 * * ********************************	r. Tor scale	MINUTES IN COMPUTATION INTERVAL STARRING DATE WINDER OF TYME MUMBER OF HYDROGRAPH ORDINATES ENDING THAE CENTRY MARK		COND	*** ***		PRINT CONTROL PLOT CONTROL HYDROGEAH PLOT SCALE PUNCH COMPUTED HYDROGRAPH PAGE 6	and Samuel Samuel Samuel Samuel Samuel Samuel Samuel
* VERSION 4.0.1E * * RUN DATE TIME * * TIME *	5 IO OUTPUT CONTROL VARIABLES TERNT 1 PRINT CONTROL 1 PLOT 0 PLOT CONTROL OSCAL 0. HYDROGRAPH PLOT SCALE	IT HYDROGRAPH TIME DATA NATH 10	COMPUTATION INTERVAL 0.17 HOURS TOTAL TIME BASE 26.50 HOURS	ENGLISH UNITS DATABAGE ABAR PRECIPITATION DEPTH INCHES LENGTH, ELEVATION FEET FLOW STORAGE VOLUME STORAGE VOLUME STORAGE STORAGE STORAGE TEMPERATURE TEMPERATURE DEGREES PAHENHEIT	*** *** *** *** *** *** *** *** *** *** *** *** ***	6 KK * Pondl * * ********************************	7 KO OUTPUT CONTROL VARIABLES 1 PRINT CONTROL 1 PLOT 0 PLOT CONTROL 0 SCAL 1 PUNCH COMPUTEI	

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			**					*						
			TYPE OF INITIAL CONDITION					k k k						
			INITIAL (87.6	490.00	26.		K K K						
			YPE OF]	76.2		26.		: : : :						
			ELEV T		48	2		:						
			Q,	65.0	489.00	26.		:						
			ITYP	53.8	488.50	26.								2
				42.8	488.00	26.		****						
	PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH OF THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		ENT	31.9	487.50 4	26.	* *				PRINT CONTROL HYDROGRAPH ELOT SCALE PUNCH COMPUTED HYDROGRAPH FYST HYDROGRAPH OF HYBS UNIT FIRST CROINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	ss.	Page 8	
	PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE SANE HYDROGRAPH SANE HYDROGRAPH SANE HYDROGRAPH LENST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 486.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	21.2		26.	·, ·				PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE FUNCH COMPUTED HYDROGRAPH SANE HYDROGRAPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVEI LAST ORDINATE PUNCHED OR SAVEI TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME	Δι	
	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGRAPH ON THI SAVE HYDROGRAPH ON THI FIRST ORDINATE PUNCHED TIME INTERVAL IN HOUR		NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFF		487.00						PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROGI SANTE HYDROGRAPH ON THE FIRST ORDINATE PUNCHED TIME INTERVAL IN HOURE	SERIES TIME INTERVAL STARTING DATE STARTING TIME		
υ			NUMBER INITIA WORKING	10.5	486.50	o,								
CNAME	OUTPUT CONTROL VARIABLES 1 PROT 0 GSCAL 0. 1 PROCH 0 1 OUT 1 SAV2 1 SAV2 1 SAV2 1 SAV2 1 SAV3 1 160 1 ISAV3 1 160	NG DATA		0.0	486.00	0.					OUTPUT CONTROL VARIABLES IPROT 0 0 SCRAL 0 1 IPNCH 2 1 ISAV1 1 1 ISAV1 1 1 ISAV2 160 TIMINT 0.167	DATA FOR INPUT TIME JXMIN 6 JXDATE 1JAN94 JXTIME 0		
* * * *	I CONTROL IPRNT IPROT OSCAL IPNCH IOUT ISAVI ISAVI ISAVI	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	AGE	NOI	RGE		* *	* *	* *	T CONTROL IPRNT IPLOT GSCAL IPNCH IOUT ISAVI ISAVI	DATA FOR 1 JXMIN JXDATE JXTIME		
** Pipel ******	TUTPUT	HYDROGRA	STORAG	STORAGE	ELEVATION	DISCHARGE		****	Pond2	* ********	TUTTOO	TIME O		-
								* * *	* * '	* *				
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160 sv	V)	STORAGE	0.0	0.0	2.4	4.8	7.2	9.6	12.1	14.6	17.2	19.7
162 SE	E E	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
164 SQ	DIS	DISCHARGE	186.	7.	19.	35.	53.	72.	93.	116.	139.	162.
166 SE	ELE	ELEVATION	484.00	484.50	485.00	485.50	486.00	486.50	487.00	487.50	488.00	488.50
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				COMPU	red storage	-OUTFLOW-E	COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	DATA				
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				I	RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE M. PAGE 14	RUNOFF SUMMARY CUBIC FEET PER RS, AREA IN SI Page 14	FF SUMMARY C FEET PER SECOND AREA IN SQUARE MILES Page 14	SE		÷		

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rt t	FOR MAXIMU	24-HOUR	15.	11.	14.	16.	43.	24.		54.	51.		
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	OPERATION		HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	нуркоскарн ат	4 COMBINED AT	ROUTED TO	*** NORMAL END OF HEC-1 ***	
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U.S. ARMY CORPS OF ENGINEERS HYDROLOGIC ENGINEERS OGO SECOND STREET ONUS, CALIPORIA 95616 (916) 551-1748	0.5 PAP Usine al Q Pelishine Perio E. Max Discurace Q Pends 1.2 E.3	ECIGS, HECIDB, AND HECIKW. MITH THE 1973-STYLE INPUT STRUCTURE. 1. THIS IS THE FORTRANTY VERSION SS:RRITE STAGE FREQUENCY,	PAGE 1.8910			73 0.0083 0.0094 85 0.0196 0.0208 38 0.0452 0.0466 83 0.0598 0.0614 47 0.0764 0.0782
Havana6.out	X X X X X X X X X X X X X X X X X X X	THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KM. THE DEFINITIONS OF VARIABLES -RTIM9- AND -TTICR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKM- ON PAW-CARD MAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORFIGANTY VERSION BOS PROBLOT DAMBRES OUTLOOW SUBHREGREED., SINGLE EVENT DAMAGE CALCULATION, DSS.WRITE STRIGE FREQUENCY, KINEWATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM	HEC-1 INPUT	1JAN94 0 160	0 0 1 22 1Jan94 0	0.001 0.002 0.0031 0.0041 0.0051 0.0062 0.0073 0.01161 0.023 0.0185 0.01
FLOOD HYDROGRAPH PACKAGE (HEC-1) MAY 1991 VERSION 4.0.1E RUN DATE TIME		THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF 1 THE DEFINITIONS OF VARIABLES -FRIMP- AND PRYOR- THE DEFINITION OF -ANSKK- ON RM-CARD WAS CHANGEN NEW OFFICKS: DAMBREAX OUTFOW SUBRESCENCE, SIND DSS.READ THES SERIES AT DESIRED CALCULATION WITH KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM	LINE ID12.	1 ID 2 ID 3 ID 4 IT RIO LOS 5 IO LOS	6 KK Pondi 7 RA 0.036 8 BA 0.038 9 PB 16 10 IN 6 137 * precipi	0.10.01.10.00.00

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	22 1 160 0.167	HYDROGRAPH ROUTING DATA	486.00 0.00	0.0	11.	486.00		**		New proposed ash pond	OUTPUT CONTROL VARIABLES 1 PROT 0 0 GSCAL 0. 1 RNCH 2 1 LOUT 22 1 ISAV1 1 1 ISAV2 160 1	DATA FOR INPUT TIME S JXMIN 6 1 JXDATE 1JAN94 S JXTIME 0	ATA	SUBBASIN CHARACTERISTICS TAREA, 0.07 s	FLOW CHARACTERISTICS STRTQ 11.90 I GRCSN 0.00 B RTIOR 1.00000 R
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	CIPITATIO	000000000000000000000000000000000000000	FION DUS AREA		*	UNIT HYDROGRAPH END-OF-PERIOD ORDINATES 3. 1. 0.	*** *** *** *** ***			SCALE AYDROGRA; ON THIS PUNCHED OF	Pag	
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	_		SUBREACHES, ONDITION AND D COEFF	44.5	493.00	31.		,	* * * * * *					PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT STATE SAVE HYDROGRAPH ON THIS UP FIRST ORDINARY DE VONCHED OR LAST ORDINARY PUNCHED OR LAST ORDINARY PUNCHED OR TIME INTERVAL IN HOURS	VAL IN MING ATE IME		REA	OW FLOW RECES CONSTANT		PRECIPITA	
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		HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE			*** *** ***	*****	*	Pond3 *	*******	OUTPUT CONTROL VARIABLES 1 FRONT 0 0 COSCAL 0. 1 POUCH 1 1 SAVI 1 1 SAVI 167 1 SAVI 167 1 SAVI 160 1 SAVI 167	TIME DATA FOR INPUT TIME OXNEIN 6 5 JXDATE 1JAN94 JXTIME 0	SUBBASIN RUNOFF DATA	SUBBASIN CHARACTERISTICS TAREA, 0.01	BASE ELOW CHARACTERISTICS STRTQ 0.00 . QRCSN 0.00 I RTIOR 1.00000 I	PRECIPITATION DATA	STORM	
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	* * *			Q Q			7.2	486.00	53.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	9.64 72.40 486.50		F SUMMARY : FEET PER SECOND AREA IN SQUARE MILES Page 14
	Havana6.out			LE OGRAPH THIS UNIT HED OR SAVE ED OR SAVE URS		/ FICIENT	4.8	485.50	35.	485.50	*	-outflow-E	7.18 52.74 486.00		OFF SUMMARNIC FEET PEI AREA IN S Page 14
	* * *			PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PRONCH COMPUTED HYDROGRAPH FRAST ORDINATE PUNCHED ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 404.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	2.4	485.00	19. 235.	485.00		ED STORAGE	4.76 34.87 485.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE M. Page 14
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out	FOR MAXIMUM	24-HOUR	15.	11.	14.	16.	43.	24.	4.	54.	51.			 51
Havana6.out	AVERAGE FLOW FOR MAXIMUM PERIOD	6-HOUR	44.	21.	39.	28.	.66	39.	10.	95.	.986.			Page 15
	TIME OF	Š.	12.00	13.17	12.00	12.67	12.00	14.17	12.00	12.00	15.33			
	PEAK		317.	23.	284.	35.	650.	40.	74.	131.	92.			
	NO.	SINITON	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	* *		
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Effluent Pipe Analysis Havana Power Station East Ash Pond #3B

January 2, 2002 JHK

The discharge from pond #3 is carried to the Illinois River by a 36-inch round reinforced concrete pipe. The pipe is fitted with Anderson Seals - a three-part rubber joint seal that allows the pipe to operate under pressure without leakage at the joints. Under normal conditions, the pipe does not flow full. At high flow conditions, water will back up in the stop log structure, pressurizing the effluent pipe.

The following conditions were analyzed using the FlowMaster program from Haestad.

- 1. 100-year, 24-hour storm, will all ponds discharging through the effluent pipe.
- 2. The ½-PMP storm, with all ponds discharging through the effluent pipe.

The results of the pressure pipe analysis for each of the two conditions is summarized below:

Condition	Required Flow (cfs)	Pressure at Pipe Inlet
1	42	neg. head- pipe not full
2	93	9.99 psi (~23' head)

Condition 2 would cause some water to overflow from the manholes located along the length of the 36" effluent pipe, due to the high pressure. This is acceptable because of the small likelihood of the 1/2-PMP storm and general flooding in the area from sources other than the pond.

However, as an additional precaution, the standpipe in pond 2 will be modified to restrict water flow into pond 3 once pond 3B is put into service. Pipe diameter will be reduced from 3' \$\phi\$ to 1.5' \$\phi\$. Two additional HEC-1 runs were made to investigate effects on possible pressure and flow through first manhole:

- 1. Discharge from pond 2 reduced to reflect restricted flow. The HEC-1 analysis showed that flow at the outlet structure was reduced to 82 cfs, which translates into approximately a 13' head at the 1st manhole.
- 2. Same as above plus plant flow of 11.9 cfs stopped. This condition may require change in plant operating procedures if water is seen discharging through manhole. The HEC-1 analysis showed that flow at the outlet structure was reduced to 72 cfs, which translates into approximately a 6.9' head at the 1st manhole and 5.5' head at the 2nd manhole. The existing 1st manhole configuration shows that it is capable of containing up to 10.5' of head, which is greater than the 6.9' head calculated and 6.8' head at the 2nd manhole which is greater than the 5.5' calculated, therefore no overflow occurs once plant flow is stopped.

HA WD

Ξff.	press.@93 cfs (0.5 PMP-16" storm)
	Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 2 cfs effluent flow Pressure Pipe 93
Flow Element	Pressure Pipe 93
Method	Hazen-Williams Formula
Solve For	Pressure at 1

Input Data		
Pressure at 2	0.00 psi	
Elevation at 1	464.00 ft	455
Elevation at 2	448.30 ft	
Length	3,684.00 ft	3, 5 5 5
C Coefficient	140.0	
Diameter	36.00 in	
Discharge	41,742.0 gal/min	_= 93 cfs

Results				
Pressure at 1	9.99	psi	⊸ 23.i ¹	head
Headloss	38.75	ft		
Energy Grade at 1	489.74	ft		
Energy Grade at 2	450.99	ft		
Hydraulic Grade at 1	487.05	ft		
Hydraulic Grade at 2	448.30	ft		
Flow Area	7.07	ft²		
Wetted Perimeter	9.42	ft		
Velocity	13.16	ft/s		
Velocity Head	2.69	ft		
Friction Slope	0.0105	17 ft/ft		

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FlowMaster v5.15 Page 1 of 1 4.3

Eff. pipe press. @42cfs(100 yr storm 7") Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pressure at 42 cfs effluent flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Pressure at 1

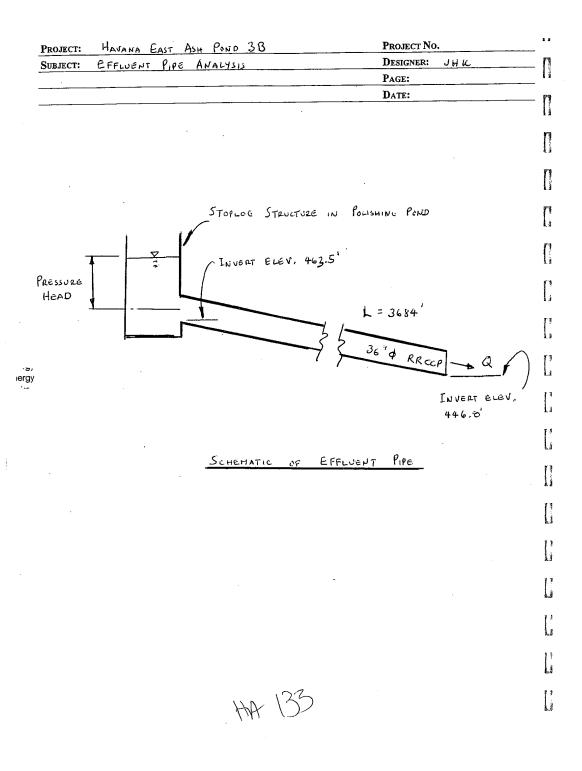
Input Data	
Pressure at 2	0.00 psi
Elevation at 1	464.00 ft
Elevation at 2	448.30 ft
Length	3,684.00 ft
C Coefficient	140.0
Diameter	36.00 in
Discharge	18,850.0 gal/min = 42cfs

Results			_				
Pressure at 1	-2.95	psi	PIPE	Deas	NOT	FLOW	PULL
Headloss	8.89	ft					
Energy Grade at 1	457.74	ft					
Energy Grade at 2	448.85	ft					
Hydraulic Grade at 1	457.19	ft					
Hydraulic Grade at 2	448.30	ft					
Flow Area	7.07	ft²					
Wetted Perimeter	9.42	ft					
Velocity	5.94	ft/s					
Velocity Head	0.55	ft					
Friction Slope	0.0024	13 ft/ft					

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FlowMaster v5.15 Page 1 of 1



Submerged standpipe discharge Worksheet for Pressure Pipe

Project Description	
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Pond 3B-Submerged standpipe flow
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	0.43 psi
Pressure at 2	2.60 psi
Elevation at 1	6.00 ft
Elevation at 2	0.00 ft
Length	150.00 ft
C Coefficient	135.0
Diameter	36.00 in
Elevation at 2 Length C Coefficient	0.00 ft 150.00 ft 135.0

Results		
Discharge	31,378.0	gal/min
Headloss	0.99	ft
Energy Grade at 1	8.51	ft
Energy Grade at 2	7.52	ft
Hydraulic Grade at 1	6.99	ft
Hydraulic Grade at 2	6.00	ft
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Velocity	9.89	ft/s
Velocity Head	1.52	ft
Friction Slope	0.0066	32 ft/ft

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FlowMaster v5.15 Page 1 of 1

			(0.5 PMP-16" storm) r Pressure Pipe
Project Description	in .	 	-
Project File	c:\haestad\fmw\ha		_
Worksheet	Pressure at 92 cfs	effluent flow	
Flow Element	Pressure Pipe Hazen-Williams Fo	ormula	
Method Solve For	Pressure at 1)))))dia	_
			-
Input Data		- -	
Pressure at 2	0.00 psi		
Elevation at 1	465.00 ft		
Elevation at 2 Length	448.30 ft 3,684.00 ft		
C Coefficient	140.0		
Diameter	36.00 in	a	
Discharge	36,805.0 gal/min	= 82 645	
Results	6.06 p	si ~ 14'	head @ OUTLET STRUCT.
Pressure at 1 Headloss	30.69 fi		head: E dotter stroot.
Energy Grade at	_		(3684-273') : 1296' @ 150 HANHOLE
Energy Grade at	2 450.39 f	14	(3684 - 275) 12 76 C 1 HANHOLE
Hydraulic Grade			3484
Hydraulic Grade			
Flow Area Wetted Perimeter		²	
Vetted Perimeter Velocity		t/s	
Velocity Head	2.09 f	t	·
Friction Slope	0.008330 f	t/ft	
		æ,	NEW HAPMONE (700 FURTHER PHONET
			3684 - 173 - 700) = 10.3 @ NEW HAPARE
		14 (3684 - 173 - 700 - 10.3 6 400
			:684
			/
		HA	FlowMaster v5
АМ	Haestad Methods, Inc.	37 Brookside R	

Eff. press.@72 cfs (0.5 PMP-16" storm) Worksheet for Pressure Pipe

	Worksheet for Pressure Pipe
П	
	Project Description
	Project File c:\haestad\fmw\havana3b.fm2
ſi	Worksheet Pressure at 92 cfs effluent flow
1 1	Flow Element Pressure Pipe
	Method Hazen-Williams Formula
	Solve For Pressure at 1
1.7	
64	Input Data
	Pressure at 2 0.00 psi
	Elevation at 1 465.00 ft
11	Elevation at 2 448.30 ft
i /	Length 3,684.00 ft
	C Coefficient 140.0 Diameter 36.00 in
	Discharge 32,316.0 gal/min = 72 cfs
11	22,510.0 gainini - 14 673
·	
	Results
1. 1	Pressure at 1 3.22 psi \$ 743 head @ OUTLET STRUCT.
E-3	Headloss 24.12 ft
	Energy Grade at 1 474.03 ft 7.43 (3684-2721)
1. 1	Energy Grade at 2 449.91 ft 7.43 (3684 - 272') : 6.88' C 1 MANHOLE Hydraulic Grade at 1 472.42 ft 3684'
[]	Hydraulic Grade at 2 448.30 ft
	Flow Area 7.07 #2
	Wetted Perimeter 9.42 ft \$\dagger\$ of 3 \left \text{Pipe} = 4.63.5
()	Velocity 10.19 ft/s
[]	Velocity Head 1.61 ft GRADE ELEV. 468
	Friction Slope 0.006547 ft/ft
	468
i_)	- 463.5
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ì	3 O' STICK-UP ABOVE GRADE
	3.0' EXTENSION PIECE 10.5' ABOVE & OF PIECE >7.43'
	10.5 ABOVE & OF PIPE >7.43
i r	
11	@ NEW MANHOLE (700 FURTHER DEWASTREAM)
	C New Manager Control of the Control
	and/and/and/and/and/and/and/and/and/and/
	7.43'(3684'-273'-700') = 5.47' @ NEW MANESCE
l. l	3684
	12/14/01 GRADE ELEY. 466' - 463.2' & OF PIPE + 3.0' STICK - UP - (8' > 5.47' OK FlowMaster v5.15
	- 463 2' & OF PIPE
()	+ 2.0' STICK - UP
	6.8 7 5.47 OK
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	0.000000000000000000000000000000000000		31.94	26.2		0.0031 0.0031 0.0354 0.0358 0.0523 0.0523 0.0555 0.0555 0.1556 0.1271 0.1266 0.1271 0.1266
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		SUBBASIN AREA			PATH		RAPH LAG		ů.	* * * * *		aı		
	DATA	CTERISTICS 0.03	DATA	16.00	L PRECIPITATION PATTERN. 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.00	0.00 100.00 100.00	ESS UNITGRAPH 0.15 LAG		15.	* * * * *		CNAME	VARIABLES 4 0 0.0	
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	HAVADA.OUT SAVE HYDROGRAPH ON THIS UNIT FERST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	HNEL	29.4	29.	487.50	* * * * * * * * * * * * * * * * * * *		PRINT CONTROL PLOT CONTROL HYDROGARPH PLOT SCALE HYDROGARPH PLOT SCALE SAVE HYDROGGARPH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	ស			SION Page 10
	Havana.ou SAVE HYDROGRAPH ON THIS UNIT FERST ORDINATE PUNCHED OR SA LAST ORDINATE PUNCHED OR SAV TYME INTERVAL IN HOURS	NUMBER OF SUBREACHES/ INITIAL CONDITION WORKING R AND D COEFFICENT	19.5	29.		* * * *		PRINT CONTROL PLOT CONTROL PLOT CONTROL PUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UI E.RST ORDINATE PUNCHED OR LAST ORDINATE PUNCHED OR TIME INTERVAL IN HOURS	IN MINUTES			TERISTICS 11.90 INITIAL FLOW 0.00 BEGIN BASE FLOW RECESSION 1.00000 RECESSION CONSTANT Page
	HYDROGRA : ORDINAT ORDINATE INTERVAL	NUMBER OF SUBREACH! INITIAL CONDITION WORKING R AND D COJ			0 487.00	* * * * * * * * * * * * * * * * * * * *	ash pond	PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE SAVE HYDROGRAPH POON THI ETRST ORDINATE PUNCHED LAST ORDINATE PUNCHED THME INTERVAL IN HOURG	SERIES TIME INTERVAL 1 STARTING DATE STARTING TIME		SUBBASIN AREA	AL FLOW BASE FLC SION CONE
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	PITATIC	000000000000000000000000000000000000000	TON US AREA		*	UNIT HY	* * * *			SCALE HYDROGRE ON THIS PUNCHED UNCHED	ů.	
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	BASIN T	CON PATT 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.		APH LAG		10.	* * *		٥			
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		DITION					* * * *												
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		ELEV TYP	158.0	495.50	58.		* * *												
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	Havana.out	ICIENT	67.0	493.50	58.	* *	***					RAPH IS UNIT D OR SAVEI OR SAVE	S -			NOIS		NOI	Page 12
		BREACHES/ IDITION ID D COEFF	44.5	493.00	31.		***					DI. PLOT SCALE TED HYDROG TAPH ON TH ATE PUNCHED TE PUNCHED TE TONCHED AL IN HOUR	L IN MINU E		et.	LOW RECEST		PRECIPITA	щ
		1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	22.2	492.50 4	11.		* * * *					PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE SAVE HYDROGRAPH FIRST ORDINATE BUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		SUBBASIN AREA	S INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	
()	G DATA		0.0	492.00			***							ГA		: FLOW CHARACTERISTICS STRTQ 0.00 IN QRCSN 0.00 BE RTIOR 1.00000 RE	ra.	16.00 BF	
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	000000000000000000000000000000000000000	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA			r *		PRINT CONTROL PLOT CONTROL HYDROGRAPH FOR SCALE BUNCH COMPUTED HYDROGRAPH SAVE HYDROGRAPH ON THIS UN FIRST OKINARTE PUNCHED OR LAST ORDIVARE PUNCHED OR TIME INTERVAL IN HOURS NIME INTERVAL IN HOURS	HYDROGRAI	
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		SCS LOS	scs DIN		. **	* * * * * * * * * * * * * * * * * * *	TUGTUO	HYDROG	
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	127 PI	152 LS	153 UD		*	154 KK	155 KO	156 HC	

	* * * * * * * * * * * * * * * * * * *				CONDITION	19.7	488.50	162.	488.50					
П	**************************************				OF INITIAL CONDITION	17.2	488.00	139.	488.00			19.75 162.12 488.50		
	***************************************				TYPE	14.6	487.50	116.	487.50			17.17 138.53 488.00		
i)	* * * * * * * * * * * * * * * * * * *				ELEV	12.1	487.00	93.	487.00			14.63 115.56 487.50		
	* * * * * * * * * * * * * * * * * * * *				ITYP	9.5	486.50	72.	486.50		ATA	12.12 93.44 487.00		S
	* * * *		ED O			7.2	486.00	53.	486.00		STORAGE-OUTFLOW-ELEVATION DATA	9.48 72.40 486.50		RUNOFF SUMMARY FLOW IN CUBIC FEET PER SECOND TIME IN HOURS, AREA IN SQUARE MILES Page 14
	Havana,out		LE OGRAPH THIS UNIT HED OR SAVE ED OR SAVE URS		/ FICIENT	4.8	485.50	35.	485.50	* *	-outflow-ei	7.18 52.74 486.00		DFF SUMMARN IC FEET PEF AREA IN S Page 14
	**		S PRINT CONTROL PLOT CONFROL HURGORARH BLOT SCALE HURGORARH ON THIS UNIT FIRST ORDINATE PUNCHED OR SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 484.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	2.4	485.00 490.00	19. 294.	485.00		ED STORAGE-	4.76 34.87 485.50		RUNC LOW IN CUBJ IN HOURS,
	***	ABC	PRINT CONTLAND PLOT CONTLAND HYDROGRAP PUNCH COMSAVE HYDR SAVE HYDR LAST ORDITANT INME INTE		NUMBER OF INITIAL C WORKING R	0.0	484.50	7.	484.50		COMPUTED	2.36 19.31 485.00	27.64 293.60 490.00	FIME
	* **	CNAME	CONTROL VARIABLES 1PRNT 0 1 PROST 1 COUT 2 2 SAN1 1 3AV2 160 MINNT 0.167	NG DATA		0.0	484.00	0. 210.	484.00			0.00 6.95 484.50	24.98 234.92 489.50	
- opp dis	***	* * * * * * * * * * * * * * * * * * *	UT CONTROL IPRNT IPLOT QSCAL IPNCH IPNCH ISAVI ISAVI	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE	ELEVATION			0.00 0.00 484.00	22.35 210.47 489.00	
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	* * * * * * * * * * * * * * * * * * *	157 KK	158 KO		159 RS	160 SV	162 SE	164 SQ	166 SE			ы		D
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	TIME OF	MAN DIRGE		13.17		13.17		14.17			15.67		
	MAXIMUM	SIAGE		486.92		486.71		493.17			486.72		
	BASIN	AKEA	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15		
	M PERIOD	72-HOUR	14.	10.	12.	11.	40.	22.	ĸ,	45.	42.		
out	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	15.	11.	14.	12.	43.	24.	4	49.	. 96		
Havana.out	AVERAGE FLO	6-HOUR	44.	21.	39.	19.	66	39.	10,	86.	78.		
	TIME OF	7 1 1	12.00	13.17	12.00	13.17	12.00	14.17	12.00	12.00	15.67		
	PEAK		317.	23.	284.	21.	650.	40.	74.	121.	82.		
	20 H	STATION	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	ABC	Stplog	* * *	
	100	OPERATION	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	ROUTED TO	HYDROGRAPH AT	4 COMBINED AT	ROUTED TO	*** NORMAL END OF HEG-1 ***	
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	Havana.out	XXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	HEC-1 KNOWN - HAVE CHAIN SIE EVENT I	HEC-1 INPUT		55	0.0041 0.015 0.0269 0.0398 0.0538
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		****	TOUS VER RTIME- A M-CARD W SUBMERGE D CALCUL	.2.	94	0 0	01 0.002 32 0.0127 32 0.0244 58 0.0371 94 0.0508
	(HEC-11) **		ALL PREVIABLES - IABLES - KK- ON R OUTFLOW T DESIRE	ID2,	1 10 1JAN94 4	1d1 0 0 158 16 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10 0.001 05 0.0116 22 0.0232 45 0.0358 48 0.0494 63 0.0646
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			BASIN TOTAL PRECIPITATION	00000000000000000000000000000000000000	INITIAL ABSTRACTION CURVE NUMBER PERCENT IMPERVIOUS AREA		7 END-	* * * * * * * * * * * * * * * * * * * *		PRINT CONTROL PLOT CONTROL HYDROGRAPH PLOT SCALE PUNCH COMPUTED HYDROG SAVE HYDROGRAPH ON TH. TERSY ORDINATE PUNCHED LAST ORDINATE PUNCHED THE INTERVAL IN HOURI	
!				PRECIPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.		RAPH LAG	10.	* * * * * * *	Ω		
		DATA	16.00	PRECIPITA 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	0.00 100.00 100.00	ESS UNITGRAPH 0.15 LAG		* * * *	CNAME	OUTPUT CONTROL VARIABLES 1 PROT 0 GSCAL 1 FRACH 1 IOUT 1 ISAV2	
		PRECIPITATION	STORM	INCREMENTAL 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00	LOSS RATE STRTL CRVNBR RTIMP	DIMENSIONLESS TLAG	109.	***	* * * * * * * * * * * *	UT CONTROI IPRNT IPLOT QSCAL IPNCH IOUT ISAVI ISAVZ	
		PREC		Z	SCS	SCS	122.	* * * * *	* * * * * * * * * * * * * * * * * * *	OUTP	
			en C	I.	LS	QD		* *		9	
			86	64 60 60	113 1	114 U		* * * * *	115 KK	116 KO	
					\	<i>A</i>	Z.				
					2	47.44	\$ 162				

	ONDITION					* * * * * * *											
	TYPE OF INITIAL CONDITION	181.1	496.00	58.		* * * * * *											
	ELEV TYPE OF	158.0	495.50	58.		*** ***											
	ផ	135.1	495.00	88 9		* * * *											
	IIYP	112.3	494.50	58.		* * * * * *											
		9.68	494.00	. 89		* * * * *											
	s/ FICIENT	67.0	493.50	88	* *	***				ALE ROGRAPH THIS UNIT CHED OR SAVE JURS	INUTES			CESSION		ITATION	Page 12
	1 NUMBER OF SUBREACHES/ 492.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	44.5	493.00	31.		* * * * *				PRINT CONTROL PLOT CONTROL PUOT CONTROL PUNCH COMPUTED HYDROGRAPH PROFESSARE HYDROGRAPH OF THIS UNIT FIRST ORDINATE PUNCHED OR SAVED THME INTERVAL IN HOURS	SERIES TIME INTERVAL IN MINUTES STARTING DATE STARTING TIME		AREA	INITIAL FLOW BEGIN BASE FLOW RECESSION RECESSION CONSTANT		BASIN TOTAL PRECIPITATION	
	NUMBER OF INITIAL (22.2	492.50	11.		* * * * * *				PRINT CONTROL PLOT CONTROL HYDROGRAPH PL PUNCH COMPUTE SAVE HYDROGRA FIRST ORDINAT LAST ORDINAT TIME INTERVAL	SERIES TIME INTERVAL STARTING DATE STARTING TIME		SUBBASIN AREA	TERISTICS 0.00 INITIAL FLOW 0.00 BEGIN BASE FI 1.00000 RECESSION COI		BASIN TO	
NG DATA		0.0	492.00	.0		* * * * *				UTPUT CONTROL VARIABLES IPROT CSCAL IPRCH IOUT ISAVI	DATA FOR INPUT TIME SERIES JYKHIN 6 TIME II JXDATE 1JAN94 STARTII JYTIME 0 STARTII	DATA	SUBBASIN CHARACTERISTICS TAREA, 0.01	FLOW CHARACTERISTICS STRTQ 0.00 QRCSN 0.00 RTIOR 1.00000	DATA	16.00	
HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE	ELEVATION	DISCHARGE		***	* *	* * *	* * * * * * * * * * * * * * * * * * * *	UT CONTROL IPRNT IPLOT QSCAL IPNCH IOUT ISAVI ISAVI ISAVI	DATA FOR JXMIN JXDATE JXTIME	SUBBASIN RUNOFF DATA	BASIN CHARF TAREA,	E FLOW CHAR STRTQ QRCSN RTIOR	PRECIPITATION DATA	STORM	
HYDROG	STOR	ST	ELEV.	DISC		* * * * * * *	*************	* Pond3	******	OUTE	TIME	SUBBAS	SUBE	BASE	PREC		
	117 RS	118 SV	119 SE	120 SQ		* * * * * * * * * * * * * * * * * * * *		121 KK		122 KO	126 IN		123 BA	124 BF		125 PB	
	-	נ	г			*											
										HATE	3						

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	0.00 0.00				*** *** *** *** *** *** *** *** ***				
	HACTPITATION PATTERN 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 INITIAL ABSTRACTION 100.00 CURVE NUMBER 100.00 PERCENT IMPERVIOUS AREA	S UNITGRAPH 0.15 LAG	*** UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES 4. 1. 0.	** *** *** *** *** *** *** *** *** *** *** ***	CNAME Stplog	ARIABLES PRINT CONTROL 1 PLOT CONTROL 0. HYDROGRAPH PLOT SCALE 1 PUNCH COMPUTED HYDROGRAPH 22 SAVE HYDROGRAPH ON THIS UNIT 1 FIRST ORDINATE PUNCHED OR SAVED 160 LAST ORDINATE PUNCHED OR SAVED 0.167 TIME INTERVAL IN HOURS	1 NUMBER OF HYDROGRAPHS	*** Page 13
The second secon	127 PI INCREMENTAL PR 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.0	152 LS SCS LOSS RATE STRTL CRVNBR RTIMP	153 UD SCS DIMENSIONLESS UNITGRAPH TLAG 0.15 LAC	14, 13.	安 精水水 装草状 安米斯 安米州 可水管 音乐页 医甲基 医苯丙二甲甲基	154 KK * ABC * * * * * * * * * * * * * * * * * * *	155 KO OUTPUT CONTROL VARIABLES 1 PROT 0. 0 SCAL 0. 1 INCH 22 1 ISAV1 1 1 ISAV2 160 TIMINT 0.167	156 HC HYDROGRADH COMBINATION ICOMP	
÷ :				1/14 3	77				

			CONDITION	19.7	488.50	162.	488.50					
			TYPE OF INITIAL CONDITION	17.2	488.00	139.	488.00			19.75 162.12 488.50		
				14.6	487.50	116.	487.50			17.17 138.53 .488.00		
			SLEV	12.1	487.00	93.	487.00			14.63 115.56 487.50		
			ITYP	9.5	486.50	72.	486.50		TA	12.12 93.44 487.00		S
	0			7.2	486.00	53.	486.00		COMPUTED STORAGE-OUTFLOW-ELEVATION DATA	9.48 72.40 486.50		F SUMMARY : FEET PER SECOND AREA IN SQUARE MILES Page 14
	SRAPH IIS UNIT ED OR SAVEI O OR SAVEORS		ICIENT	4.8	485.50	35,	485.50	*	OUTFLOW-EL	7.18 52.74 486.00		RUNOFF SURMARY IN CUBIC FEET PER SECOND HOURS, AREA IN SQUARE M Page 14
	COL NL PLOT SCALE TED HYDROG SRAPH ON THE RATE PUNCHE TTE PUNCHE		JBREACHES/ NDITION ND D COEFFI	2.4	485.00	19.	485.00		D STORAGE-	4.76 34.87 485.50		RUNO FLOW IN CUBI TIME IN HOURS,
ABC	PRINT CONTROL HYDROGRAPH PLOT SCALE HYDROGRAPH PLOT SCALE SAVE HYDROGRAPH SAVE HYDROGRAPH FIRST ORDINATE PUNCHED ON SAVED LAST ORDINATE PUNCHED OR SAVED TIME INTERVAL IN HOURS		1 NUMBER OF SUBREACHES/ 484.00 INITIAL CONDITION 0.00 WORKING R AND D COEFFICIENT	0.0	489.50	235.	484.50		COMPUTE	2.36 19.31 485.00	27.64 293.60 490.00	FL
CNAME		G DATA		0.0	484.00	210.	484.00			0.00 6.95 484.50	24.98 234.92 489.50	
* * * * * *	OUTPUT CONTROL VARIABLES IPELOT OUTPUT INCH INCH ISAVI	HYDROGRAPH ROUTING DATA	STORAGE ROUTING NSTPS RSVRIC X	STORAGE		ARGE	TION			0.00 0.00 484.00	22.35 210.47 489.00	
* * * * * * * * * * * * * * * * * * *	OUTPU	HYDROGRA	STORAL	STO	ELEVATION	DISCHARGE	ELEVATION			STORAGE OUTFLOW ELEVATION	STORAGE OUTFLOW ELEVATION	
157 KK	158 KO		1.59 RS	160 SV	162 SE	164 SQ	166 SE				í	⊐
			M									

(10,0)													
		TIME OF	dere van		13.17		13.17		14.17			15.50	
		MAXIMUM	Strace		486.92		486.71		492.96			486.48	
				4	Ą	ñ	m	7	7	es	ıs	ıs	
		BASIN	425	0.04	0.04	0.03	0.03	0.07	0.07	0.01	0.15	0.15	
		PERIOD	72-HOUR	14.	10.	12.	11.	28.	15.	m	39.	36.	
		AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	15.	11.	14.	12.	31.	16.	4.	42.	39.	
	Havana.out	FLOW FO											
	Нач	AVERAGE	6-HOUR	44.	21.	39.	19.	88.	29.	10.	76.	. 89	
		TIME OF	PEAK	12.00	13.17	12.00	13.17	12.00	14.00	12.00	12.00	15.50	
		PEAK		317.	23.	284.	21.	638.	30.	74.	112.	72.	
		:	Z	류		75	5	33	en an	m Ti	ABC	60	
			STATION	Pondl	Pipel	Pond2	Pipe2	Pond3B	Pipe3	Pond3	A	Stplog	
			OPERATION	нуркоскарн ат	ROUTED TO	нуркоскарн ат	ROUTED TO	нүркоскарн ат	ROUTED TO	нуркоскарн ат	4 COMBINED AT	or do	
and a second			OPERA	HYDRC	ROUTE	HYDRC	ROUTE	HYDRC	ROUTE	HYDRC	4 CON	ROUTED TO	
			+	+	+ +	+	+ +	+	÷ +	+	+	+ +	
and the state of t									\.	Sh	+ =	R	

Energy Dissipation Havana Power Station East Ash Pond #3B	July 24, 2001 JHK
Energy dissipation of the pond outflow is provided by large riprap of the existing effluent pipe. Since its installation, this riprap has protection at the pipe discharge. During a period of lowering the pstoplogs, the effluent pipe carried much higher flows than normal the riprap held up and provided slope protection.	provided good slope bond by pulling
Based on this historical information, it is a reasonable assumption continue to hold up and provide good energy dissipation and slop changes are proposed as part of construction of pond #3B.	that the riprap will e protection. No
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De-watering Method and Calculations Havana Power Station East Ash Pond #3B

November 5, 2001 JHK

In the event that the pond system would need to be de-watered, the stoplog structure in the polishing pond (pond #3) will be used. It will be possible to de-water half of the total reservoir in seven days using the stoplog outlet structure as outlined below.

The partition between pond 3B and pond 3 will be breached with Illinois Power earthmoving equipment stationed at the plant or by a contractor's equipment. This will equalize the level in these ponds at a level close to elevation 492.0 feet, since the elevation of pond 3B is at 492' and of pond 3 at elevation 486' with the bulk of the volume coming from pond 3B. The total volume of water will be 1321.1 acre-feet at the start of de-watering. To reduce the volume to 660 acre-feet, the water level will need to be reduced to elevation 476.75 feet. To lower the pond 15.25 feet, 23 of the eight-inch tall stoplogs will be to be removed. Over a seven-day period, this works out to removing one stoplog approximately every 7 hours. The breach between ponds 3 and 3B will be deepened as necessary while de-watering these ponds.

The average flow during de-watering will be 47.5 cfs. The effluent pipe would not flow full at this rate. The flow measurement device downstream of the stoplog structure will be monitored during de-watering to ensure stoplogs are being removed at a sufficient rate to de-water half the pond volume in 7 days.

Pond 1 and 2 will be full of ash by the time pond 3B is finished. Therefore, ponds 1 and 2 are not considered in the de-watering plan.

The following pages contain the calculations for the de-watering plan.



De-waterin Havana Po East Ash Po	g Method and Calculations wer Station ond #3B	November 5, 2001 JHK	
Pond 3-	Pool volume at elev. 486.0'	= 138,000 cu. Yd. = 85.54 acre-ft.	
	Area at elev. 486' =	4.89 acres	
	Area at elev. 462' = =	94,471 sq. ft 2.17 acres	
	$\Delta = (4.89 - 2.17)/(486^{\circ}-462^{\circ})$) = 0.113 acres/ft.	
$V_y = 85.54 a$	acre-ft -½(4.89x2 - 0.113[486-y])(486-y)	
Pond 3B-	Pool volume at elev. 492.0'	= 1,993,412 cu. Yd. = 1235.6 acre-ft.	
	Area at elev. 492' =	1,928,962.6 sq. ft. = 44.28 acres	
	Area at elev. 460' =	1,243,043 sq. ft. = 28.536 acres	
	$\Delta = (44.28 - 28.536)/(492'-4)$.60') = 0.492 acres/ft.	
$V_y = 1235.6$	acre-ft -½(44.28x2 - 0.492[492	-y])(492-y)	
Total volum	e of pond system at elev. 486'	= 1235.6 + 85.54 = 1321.1 acre-ft.	
	1	x 169	

Pond 3 Volume = 85.54 acre-ft -(0.5)(4.89x2-0.113[486-y])(486-y)

Pond 3B Volume = 1235.6 acre-ft -(0.5)(44.28x2-0.492[492-y])(492-y)

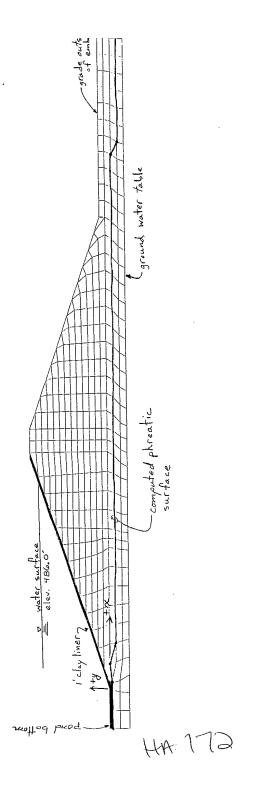
Havana De-watering volume calculations for Ponds 3 & 3B

C1 _	Elev.(ft)	Pond 3	Pond 3B	Total volume
-		volume (acre-ft)	volume (acre-ft)	(acre-ft)
1 1				
	492.00	85.54	1235.60	1321.14
	491.50	85.54	1213.52	1299.06
• •	491.00	85.54	1191.57	1277.11
f 1	490.50	85.54	1169.73	1255.27
	490.00	85.54	1148.02	1233.56
1 1	489.50	85.54	1126.44	1211.98
1 1	489.00	85.54	1104.97	1190.51
	488.50	85.54	1083.63	1169.17
1 1	488.00	85.54	1062.42	1147.96
	487.50	85.54	1041.32	1126.86
	487.00	85.54	1020.35	1105.89
[]	486.50	85.54	999.50	1085.04
	486.00	85.54	978.78	1064.32
	485.50	83.11	958.17	1041.28
	485.00	80.71	937.69	1018.40
	484.50	78.33	917.34	995.67
<u>{ } }</u>	484.00	75.99	897.10	973.09
	483.50	73.67	876.99	950.66
	483.00	71.38	857.01	928.38
í 1	482.50	69.12	837.14	906.26
	482.00	66.88	817.40	884.28
	481.50	64.68	797.78	862.46
1.1	481.00	62.50	778.29	840.79
	480.50	60.35	758.91	819.27
` '	480.00	58.23	739.66	797.90
1.1	479.50	56.14	720.54	776.68
: E : : : : : : : : : : : :	479.00	54.08	701.53	755.61
4. /	478.50	52.04	682.65	734.70
	478.00	50.04	663.90	713.93
	477.50	48.06	645.26	693.32
i_J	477.00	46.11	626.75	672.86
	476.50	44.18	608.36	652.55
	476.00	42.29	590.10	632.39
	475.50	40.42	571.95	612.38
,	475.00	38.59	553.93	592.52
	474.50	36.78	536.04	572.81
1)	474.00	35.00	518.26	553.26
		•	-	-



July 23, 2001

Seepage Analysis Havana Power Station East Ash Pond #3B The new pond will have a polypropylene liner that is impermeable for practical purposes. Since there is no seepage under normal conditions, an "adverse" condition was analyzed to determine what would happen should the liner be damaged. The following calculations are for the full head of the pond being applied directly to the one-foot clay layer under the synthetic liner. This condition could occur if the liner were to have a significant tear or The computer program Boss Seep2D was used to analyze the embankment of pond 2 for seepage. Pond 3B is adjacent to pond 2 and has similar properties to pond 2 with a smaller head, therefore Boss Seep2D was not run for pond 3B on the basis of comparison. The clay layer has a very low permeability compared to the sandy soils which form the embankment, and seepage through the clay flows nearly straight down to a phreatic surface elevation below the toe of the embankment. Therefore, seepage on the downstream face of the embankment should not occur, and a toe drain system is not needed. The Seep2D analysis for pond 2 is attached for reference.



Havana East Ash Pond #2 Seepage Analysis

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							USPAR2	.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00	able cm/sec	-2 cm/56
							USPARI	.1000E-02 .1000E-02 .1000E-02 .1000E-02 .1000E-02 .1000E-02	above table	5.54*10
	PROBLEM			000.		MATERIAL PROPERTIES	ANGLE	.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00	7. In	and @ i
	PLANE FLOW PROBLEM		#2	S393 359 IALS 12	·	MATERIA	К2	.1035E+01 .2628E+05 .0000E+00 .0000E+00 .0000E+00 .0000E+00	Ke in Affic.	Mat. # 115 clay & Mat. # 2 is sand @ 2.54 x 10 2 cm/sec permeability.
			East Ash Pond #2	F NODAL FOINTS F ELEMEN'S F DIFF. MATERIALS N OF DATUM			K1	.1035E+01 .2628E+05 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00	Y X X	Mat Mat
		,	Havana E	OUMBER OF I NUMBER OF I NUMBER OF ELEVATION			MAT	1767843978		
				AA	男 73					

.0000E+00 .0000E+00 .0000E+00			
.1000E-02 .1000E-02 .1000E-02		FLOW-HEAD	35.00 35.00 35.00 35.00 35.00 35.00 35.00
.0000E+00 .0000E+00 .0000E+00	INFORMATION	*	-10.00 -10.00 -10.00 -1.
0000E+0 0000E+0 0000E+0	NODE POINT IN	×	-20.00 -20.00 -20.00 -10.00 -10.74 -11.00 -10.74 -11.00 -1.48 -2.00 8.75 11.95 3.20 3.20 3.20 4.18 7.00 17.50 22.70 22.70 13.74
.0000E+00 .0000E+00 .0000E+00	4	NODE BC	11 22 44 11 10 10 11 11 11 11 11 11 11 11 11 11
9 11 12			

11

16.00 33.03 31.30 32.45 32.35 32.36 32.36 33.30

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106 0 79.00 -10:00 ...00
107 1 87.50 -29.17 35.00
108 0 90.72 29.17 35.00
110 0 90.72 26.25 ...00
111 0 90.82 14.58 ...00
112 0 90.85 11.67 ...00
113 0 90.90 14.58 ...00
114 0 90.90 18.5 11.67 ...00
115 0 90.90 18.5 13.3 ...00
116 0 90.90 18.5 13.3 ...00
117 0 90.90 18.5 13.3 ...00
118 0 90.91 2.92 ...00
119 0 90.92 2...33 ...00
120 0 90.95 --6.67 ...00
121 0 90.95 --6.67 ...00
122 0 90.90 20.42 ...00
125 0 90.90 20.42 ...00
126 0 90.90 20.42 ...00
127 0 90.90 20.42 ...00
128 0 100.13 14.58 ...00
129 0 100.13 14.58 ...00
130 0 100.25 11.67 ...00
131 0 100.25 11.67 ...00
132 0 100.70 --3.33 ...00
133 0 100.70 --3.33 ...00
134 0 100.70 --10.00
135 0 97.00 --10.00
136 0 97.00 --10.00
137 0 108.57 29.17 ...00
141 0 108.57 29.17 ...00
142 0 109.34 20.42 ...00
144 0 109.34 20.42 ...00
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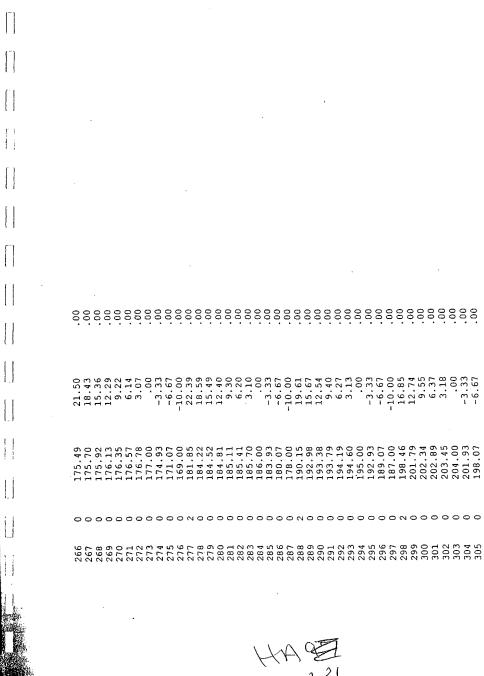
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	-3.33 -16.67 -16.60 39.00 39.00 33.00 27.00 27.00 12.00 12.00 12.00 33.11 33.11 12.05 -10.00 33.11 33.11 12.05 -10.00 33.11 33.11 12.05 -10.00 33.11 3
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	179 .

000000000000000000000000000000000000000		
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226 227 228 229 230 231 232	2336 2336 2337 2338 2339 244 244 255 255 255 255 255 255 255 255	

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        307
        2
        206.77
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        .00

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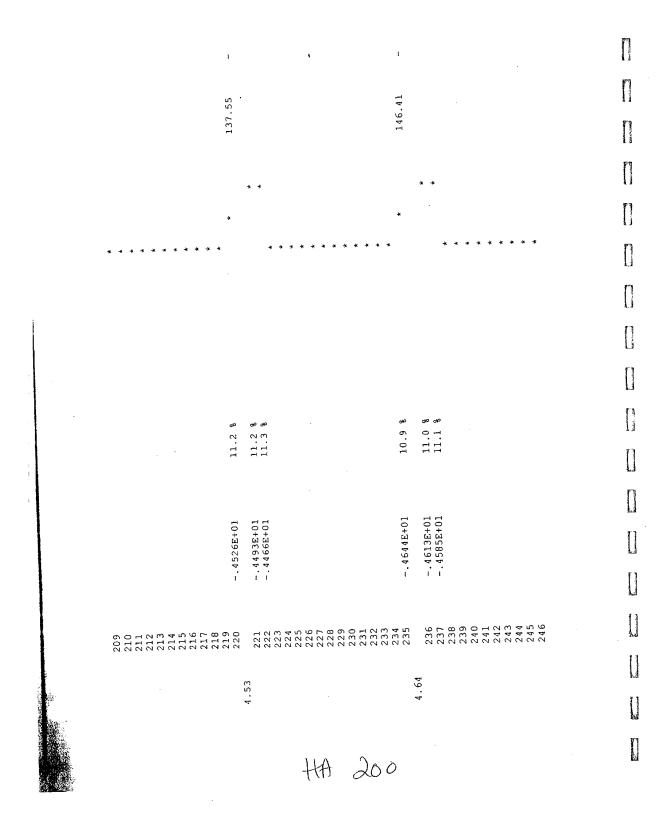
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e.	FLOW	1000E+03	2063E-01	-,1693E-01			1088E+03		-,7839E-01				1601E+00		5302E+02	.2516E+03	,	•	2178E+00		.1336E+02
AND HEADS	PERCENTAGE OF AVAILABLE HEAD	3.0 %	3.0%	3.0%	50.7 %	49.4 %	3.0 %	27.2 %	3.0%	97.78	95.6%	52.9 %	3.0%	99.7 %	99.4 %	99.4 %	100.0 %	71.0 %	3.0%	8 €.66	99.4 %
NODAL FLOWS AND HEADS	HEAD	.1390E+03	.1390E+03	.1390E+03	.2430E+04	.2372E+04	.1390E+03	.1301E+04	.1390E+03	.4693E+04	.4593E+04	,2539E+04	.1390E+03	.4792E+04	.4774E+04	4774E+04	.4804E+04	.3409E+04	.1390E+03	.4769E+04	.4774E+04
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Dam Breach Analysis December 14, 2001 Havana Power Station JHK East Ash Pond #3B The dam breach analysis was done with the use of two computer programs by Boss Corporation. The first was BREACH and the second was DAMBRK. The critical section for the dam breach analysis was taken as the northeast side of pond 3B. This portion of the dam is adjacent to a rural road with houses nearby and a manufacturing facility across the road. This section of the dam is not the highest portion, but it does represent the greatest risk of safety to life and property. The facility/houses would have a combined occupancy of 10 to 15 during a rainstorm event. Using the BOSS BREACH computer program, possible failure of the dam via overtopping will be modeled. The polypropylene liner and one-foot clay layer are ignored in the modeling due to limitations in the program and their relative small effects during a dam failure. BREACH modeled the erosion of the dam due to a 1/2-PMP (i.e.; a 16" rain in 24 hours) rainstorm washing out the top of the dam, overtopping occurring and then erosion of a section of the dam. The HEC-1 analysis results giving the maximum stage elevation of approximately 494' during the 1/2-PMP rainstorm were used as a top of the dam input to the BREACH and DAMBRK models. The topographic plans showing that the area near the northeast corner of the dam had a minimum elevation of 467', therefore this elevation was used as the input to the BREACH and DAMBRK models for the bottom of the dam. Pond water below this elevation is ignored when computing reservoir volumes. For flows into the pond during the failure, it was assumed that overtopping would begin at hour 4 of a ½-PMP storm event. The distribution of this storm is shown on the following pages. In addition to this, a plant flow of 11.9 cfs is added. From the soil reports, the average D_{50} value for embankment materials is 0.346 mm. The density for 95% of standard Proctor is 105.6 pcf. The ϕ angle is 30.4°, and the soil has negligible cohesion (C= 10 psf is used as a non-zero value). The BREACH model indicated that the dam would be protected by the vegetation for a period of time, but that failure of the dam would occur after the vegetation had eroded away. BREACH indicated a peak outflow of 14,693 cfs during the dam failure with a final breach bottom width of 9.5 feet. The side slopes of the breach were approximately DAMBRK was run to analyze the flood crest from the dam to the manufacturing facility and nearby houses. No analysis was done downstream of the manufacturing facility and houses since modeling the flow around the structures with DAMBRK would be very difficult, and give somewhat questionable results. Furthermore, the risk to life safety is greatest at these structures. The closest house is approximately 200' from the top of the dam and the INTERMET-Havana Foundry manufacturing facility is approximately 650 feet from the top of the

Dam Breach Analysis Havana Power Station East Ash Pond #3B December 14, 2001 JHK

To run DAMBRK, several criteria had to be selected and assumptions made in order for the program to run. These are listed below:

- 1. A Manning's coefficient value of 0.04 for the entire downstream channel.
- 2. The maximum top width of the downstream channel of 200 feet.
- 3. A constant turbine outflow of 100 cfs was used in order to avoid computational problems with the program.
- 4. A constant inflow of 165 cfs into the pond. This is the sum of the maximum value of the inflow hydrograph used in BREACH plus the 100 cfs assumed for turbine flow.
- 5. The grade is approximately at elevation 467 along the entire channel. A fictitious channel of 10-foot width and a constant slope of 15 feet per mile was added to avoid computational problems in the program.

The key results of the DAMBRK run are summarized below:

- Maximum outflow of 16,295 cfs. This was considered close enough to the 14,693 cfs value (~10%) calculated by BREACH to be acceptable.
- 2. The maximum stage of the breach wave is about 10 feet with a velocity of 9.3 ft/sec., at a distance of about 500 feet (.075 miles) from the dam.

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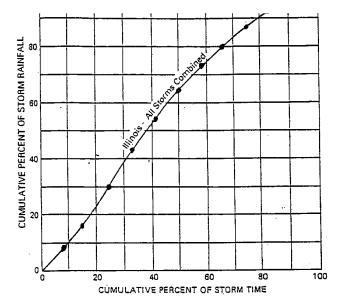


Figure 4. Median time distribution derived from combining all 261 storms from the central Illinois network

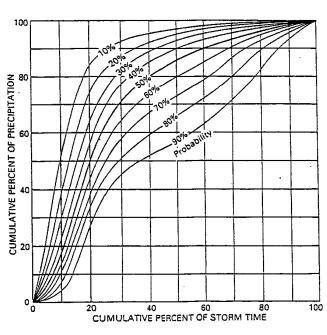


Figure 5. Time distribution of areal mean rainfall in first-quartile storms

From: <u>Time Distributions of Heavy Rainstorms in Illinois</u> by Floyd Huff, Illinois State Water Survey, 1990

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Flow into pond 3B from the 1/2-PMP storm by 2-hr. intervals

l hour	% storm	% precipitation	delta % precip.	inches rain	avg. cfs	avg.+plant inflow
2 4 6 8 10 12 14	8.33 16.66 25.00 33.33 41.66 50.00	16 30 42 53 66	8 8 14 12 11 13 8	1.28 1.28 2.24 1.92 1.76 2.08 1.28	30.35 30.35 53.12 45.53 41.73 49.32 30.35	42.25 42.25 65.02 57.43 53.63 61.22 42.25 34.66
16 18 20 22 24	66.66 75.00 83.33 91.66	80 87 92 96	6 7 5 4 4	0.96 1.12 0.8 0.64 0.64	22.76 26.56 18.97 15.18 15.18	34.66 38.46 30.87 27.08 27.08

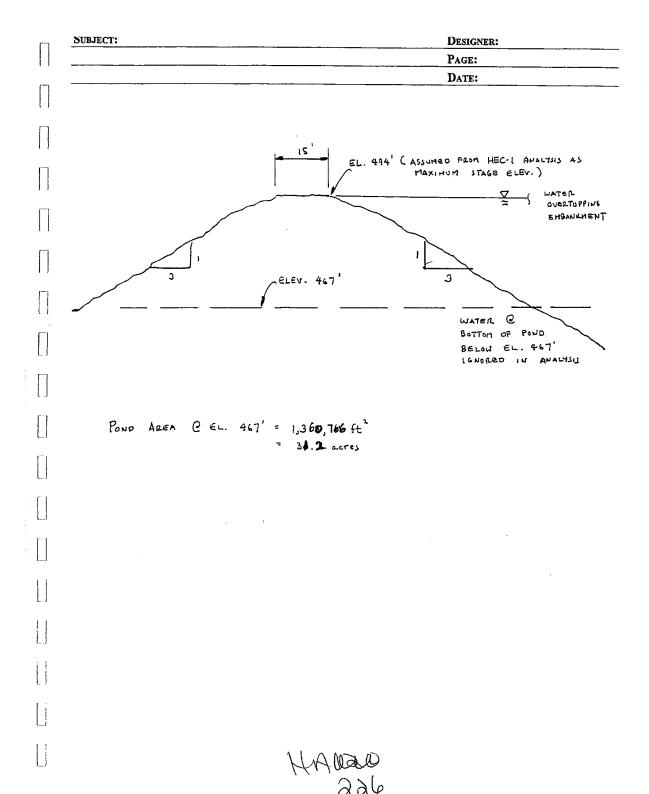
Total rainfall = 16.00

Avg. cfs = (in. rain)*2,048,802 sq. ft./[(12"/ft)(2 hrs *60 min/hr*60 sec/min)]

Plant inflow = 11.9 cfs

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BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :

PAGE 1 11/09/2001

BOSS BREACH (tm)

Copyright (C) 1988 Boss Corporation All Rights Reserved

Version Serial Number : 22205

PROGRAM ORIGIN :

Boss Breach (tm) is an enhanced version of Professor D. L. Fread's July 1988 NWS BREACH program.

DISCLAIMER :

Boss Breach (tm) is a complex program which requires engineering expertise to use correctly. Boss Corporation assumes absolutely no responsibility for the correct use of this program. All results obtained should be carefully examined by an experienced professional engineer to determine if they are reasonable and accurate.

Although Boss Corporation has endeavored to make Boss Breach error free, the program is not and cannot be certified as infallible. Therefore, Boss Corporation makes no warranty, either implicit or explicit, as to the correct performance or accuracy of this software.

In no event shall Boss Corporation be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of purchase or use of this software. The sole and exclusive liability to Boss Corporation, regardless of the form of action, shall not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :

: Calculate peak outflow during dam failu DESCRIPTION

ENGINEER : JHK

: 2:51 pm

DATE OF RUN TIME OF RUN : 11/09/2001

	BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	PAGE 2 11/09/2001
	INPUT DATA :	
	INFLOW HYDROGRAPH DESCRIPTION :	
	Time Upstream Elapsed Inflow TIN(I) QIN(I) (hr) (cfs)	
	.00 42.3 2.00 42.3 4.00 65.0 6.00 57.4 8.00 53.6 10.00 61.2	
[]	12.00 42.3 14.00 34.7	
	RESERVOIR VOLUME DESCRIPTION :	
	Elevation Surface Area HSA(I) RSA(I) (ft MSL) (acres)	
	494.00 45.3 467.00 31.2 .00 .0 .00 .0 .00 .0 .00 .0 .00 .0	
	TAILWATER CROSS-SECTION DESCRIPTION :	
	Elevation Tailwater Tailwater Top Manning Width n HSTW(I) BSTW(I) CMTW(I) (fr MSL) (ft)	
	(ft MSL) (ft) 466.90 .0 .0340 467.00 100.0 .0350 470.00 4000.0 .0350 .00 .0 .0000	
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BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	PAGE 3
RESERVOIR AND OVERTOPPING BREACH DESCRIPTION :	
Initial Reservoir Water Surface Elevation (ft MSL, HI)	494.00
Dam Bottom Elevation (ft MSL, HL)	467.00
Dam Top Elevation (ft MSL, HU)	494.00
Spillway Crest Elevation (ft MSL, HSP)	.00
Dam Crest Length (ft, CRL)	550.00
Dam Crest Width (ft, WC)	15.00
Ratio of Breach Width to Flow Depth (BR)	2.000
Initial Breach Depth on Downstream Face (ft, H)	.1000

BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	PAGE 4 11/09/2001
DAM INNER CORE DESCRIPTION :	
D50 Grain Size (mm, D50C)	.000
Ratio of D90 to D30 Grain Sizes (UNFCC)	.000
Porosity Ratio (PORC)	.000
Unit Weight (lb/cu ft, UWC)	.00
Manning n of Core Material (CNC)	.0000
Internal Friction Angle (degrees, AFRC)	.00
Cohesive Strength (lb/sq ft, COHC)	.00
Average Upstream & Downstream Inner Core Slope (ZC)	1 : .00
DAM OUTER CORE DESCRIPTION :	
D50 Grain Size (mm, D50S)	.346
Ratio of D90 to D30 Grain Sizes (UNFCS)	2.500
Porosity Ratio (PORS)	.360
Unit Weight (lb/cu ft, UWS)	105.00
Manning n of Core Material (CNS)	.0000
Internal Friction Angle (degrees, AFRS)	30.40
Cohesive Strength (lb/sq ft, COHS)	10.00
Average Clay Plasticity Index (PI)	.00
CA Clay Critical Shear Stress Coefficient (CA)	.020
CB Clay Critical Shear Stress Coefficient (CB)	.600



S BREACH version 1.10		PAGE S
ROJECT TITLE : Havana East Ash Pond #3B ROJECT NUMBER :		11/09/200
DAM FACE DESCRIPTION :		
Upstream Face Slope (ZU)	1 (vertical)	: 3.00
Downstream Face Slope (ZD)	1 (vertical)	: 3.00
Downstream Face D50 Grain Size (mm, D50DF)		.000
Downstream Face D90 to D30 Grain Size Ratio	(UNFCDF)	.000
Average Grass Length (inches, GL)		3.00
Grass Condition Factor (1=good, 0=none, GS)		.80
Maximum Grass-Lined Channel Velocity (ft/sec	, VMP)	1.50
BOUNDARY CONDITIONS :		
Simulation Duration (hr, TEH)		12.00
Basic Time-Step Size (hr, DTH)		.005
Iteration Error Tolerance (%, ERR)		.01
Downstream River Bottom Slope (ft/mi, SM)		5.000
Maximum Allowable Breach Bottom Width (ft, E	BMX)	.000
Discharge Plot Time-Step Interval (FPT)		10.00
Time-step at which Plotting Starts (TPR)		.00

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Contract of the last

	BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	PAGE 6
	INTERNAL COMPUTATION CHECKS :	
	Avg. inner & outer matl. internal friction angle (rad, AFRA) Equation 21 Thetal' (radians, TH1)	30.40 60.20
	Equation 13 Critical Depth H1' (ft, H1) Equation 21 Theta2' (radians, TH2)	.67 45.30
	Equation 13 Critical Depth H2' (ft, H2) Equation 21 Theta3' (radians, TH3)	2.16
	Equation 13 Critical Depth H3' (ft, H3)	6.95
Configuration contains		
Total Control Control		
	HA DOLS	

BOSS BREACH version 1.10	PAGE 7
PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	11/09/2001
FAILURE CODES (KG) :	
TATACA COOLO (MP)	
<pre>0 = No erosion of grassed face 1 = Erosion of dam downstream face 2 = Erosion of dam upstream face 3 = Draining of reservoir with breach size continuing to in 4 = Piping mode 5 = Collapse mode</pre>	crease
PPP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :	
<pre>1 = Depth of erosion perpendicular to downstream face 2 = Length of breach along downstream face 3 = Increase in breach width 4 = Elevation of top of piping breach</pre>	
HP DESCRIPTION BASED ON ABOVE FAILURE CODES (KG) :	
<pre>1 = Erosion width across top of dam 2 = Erosion depth at upstream face 3 = Breach flow depth 4 = Piping head</pre>	
	PAGE 60
BOSS BREACH version 1.10 PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	11/09/2001
SUMMARY OF OUTPUT RESULTS :	
GENERAL RESULTS :	
Total Number of Iterations	0
Time of Breach Failure (hr, TFHI)	.01
Total Time-Steps Used (I)	2290
Total Elapsed Time (hr, T)	7.708
Outflow Hydrograph Rising Limb Duration (hr, TRS)	.029
Time at which Significant Rise in Outflow Begins (hr, TB)	5.711
Dam Top Elevation (ft MSL, HU)	494.00
Outflow at Time Zero (cfs, QO)	.0
Simplified Time of Breach Failure (hr, TFH)	.452
TFH - Time of failure (hr) which is a linear equivalent of the outflow hydrograph rising limb duration (TRS) of by using the simplified dam-break discharge equation	OCATHEG
TFHI - Time of failure (hr) which is a linear equivalent o	f

	the outflow hydrograph rising limb duration (TRS) obtained by integrating breach outflow (QB) versus time from
	T=0 to T=Peak Outflow (TP).
at the second	
	HA day

BOSS BREACH version 1.10	PAGE 61
PROJECT TITLE : Havana East Ash Pond #3B PROJECT NUMBER :	11/09/2001
OUTPUT RESULTS AT TIME OF PEAK OUTFLOW :	
Elapsed Time (hr, TP)	5.791
Spillway Outflow (cfs)	0.
Breach Outflow (cfs, QBP)	14693.
Total Outflow (cfs, QP)	14693.
Breach Top Width (ft, BRW)	79.0
Breach Bottom Width (ft, BO)	9.5
Breach Side Slope Relative to Vertical (degrees, %)	52.15
OUTPUT RESULTS AT END OF BREACH ANALYSIS :	
Breach Depth (ft, BRD)	27.0
Breach Bottom Elevation (ft MSL, HC)	467.0
Breach Side Slope Relative to Vertical (degrees, AGL)	52.15
Reservoir Water Surface Elevation (ft MSL, HY)	475.9

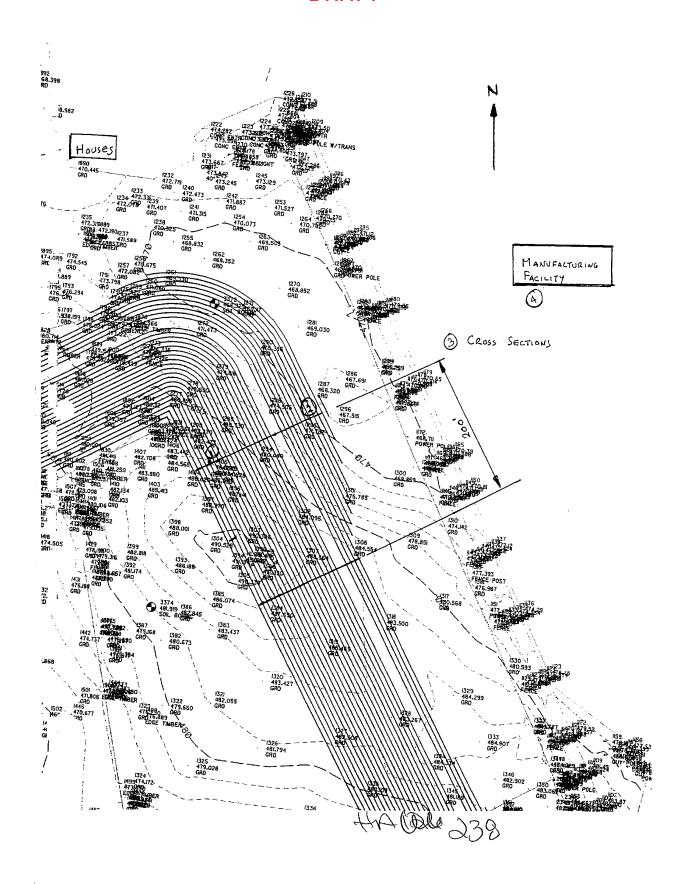
OUTPUT HYDRO								
TIME								
DISCHARGE (hr) (cfs)								
60. 20060.	2060.	4060.	6060.	8060.	10060.	12060.	14060.	16060
5.701 *			•					
5.751 *		•	•		•			
5.801 . . 14445.	-	•	•			•	. *	
5.851 . 12982.		•	•	•		•	* .	
5.901 . . 11726.	-	-	•	•	•	* .	•	
5.951 . 10640.	•	•	•	•	•	* .	•	
6.001 . 9696.	•	•	•	•	* .	•	•	
6.051 . 8869.	•		•	•	* .	•	-	
6.101 . . 8143. 6.151 .	•	•	•	*	•	•	-	
. 7500. 6.201 .	•	•	•	* .	•	•	•	
. 6930.	•	•		•	•		•	
6.301 .				•	•		•	
. 5967. 6.351 .			* .		•	•	•	
. 5559. 6.401 .			* .				•	
. 5190. 6.451 .			* .					
6.501 .		. *						
4555. 6.551	•	.*						
. 4280. 6.601 . . 4029.		*						
6.651 .		*.	•					
6.701 .		* .						
6.751 . . 3395.	-	* .						
6.801 . . 3217.	•	* .	•			-	•	
6.851 .	•	* .			•			
6.901 . . 2900.		٠.	•		•	-		
6.951 . 2759.	. *			•	•	-		

7.001 .	. *		•			•	•	-	
. 2628. 7.051 . 2506.	. *	•	•		•	•	•		•
7.101 . . 2392.	. *	•	•		•	•	•		•
7.151 . 2286.	•*	•	•	•	•	•	•		·
7.201 . . 2187.	.*	•	•	•	• *	•		•	
7.251 . 2094.	*	•	•	•					
7.301 . 2008.	*.	•	•				•	•	
7.351 . . 1926. 7.401 .	*.						-		
7.401 . 1849. 7.451 .	*.	•							
. 1777. 7.501 .	* .				-			•	•
. 1710. 7.551 .	* .		•				•	•	•
7.601 .	* .		•	•			•		٠
7.651 . 1528.	* .		•	•		-		•	-
7.701 .	* .	•	•	•	•	,			•

HA 237

END OF OUTPUT

Section Control



BOSS DAMBRK version 3.00

PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 38

PAGE 1 11/09/2001

BOSS DAMBRK (tm)

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Version : 3.00 Serial Number : 23619

Illinois Power Co.

PROGRAM ORIGIN :

Boss Dambrk (tm) is an enhanced version of Professor D. L. Fread's 1991 NWS DAMBRK program.

DISCLAIMER :

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PROJECT DESCRIPTION :

PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B

DESCRIPTION : South East side dam break analysis ENGINEER : John Kao

DATE OF RUN TIME OF RUN : 11/09/2001 : 4:04 pm

BOSS DAMBRK version 3.00		PAGE 2
PROJECT TITLE: Havana East Ash Pond PROJECT NUMBER: Pond 3B		11/09/2001
INPUT DATA SUMMARY :	•	
INPUT CONTROL PARAMETERS :		
Problem Specification Option	13	
Number of Dynamic Routing Reaches (KKN)	1	
Type of Reservoir Routing (KUI)	1	(dynamic routing)
Number of multiple dams/bridges (MULDAM)	1	
No. of Reservoir Inflow Hydrograph Points (ITEH)	2	
No. of Informational Cross-Sections (NPRT)	3	
Flood-Plain Routing (KFLP)	. 0	(no)
SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :		
2 . 3 4		
	PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B INPUT DATA SUMMARY : INPUT CONTROL PARAMETERS : Problem Specification Option Number of Dynamic Routing Reaches (KKN) Type of Reservoir Routing (KUI) Number of multiple dams/bridges (MULDAM) No. of Reservoir Inflow Hydrograph Points (ITEH) No. of Informational Cross-Sections (NPRT) Flood-Plain Routing (KFLP) SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :	PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B INPUT DATA SUMMARY : INPUT CONTROL PARAMETERS : Problem Specification Option 13 Number of Dynamic Routing Reaches (KKN) 1 Type of Reservoir Routing (KUI) 1 Number of multiple dams/bridges (MULDAM) 1 No. of Reservoir Inflow Hydrograph Points (ITEH) 2 No. of Informational Cross-Sections (NPRT) 3 Flood-Plain Routing (KFLP) 0 SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :

HA 00079

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 3

CROSS-SECTION NUMBERS COINCIDENT WITH UPSTREAM DAM FACE (IDAM) :

1

RESERVOIR VOLUME DESCRIPTION :

Elevation vs. Surface Area Table

HA 24)

DSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B	PAGE 11/09/200
DAM NUMBER : 1	
RESERVOIR AND BREACH PARAMETERS :	
Initial Elevation of Water Surface (YO, ft MSL)	494.0
Breach Side Slope (Z)	1: 1.0
Breach Bottom Elevation (YBMIN, ft MSL)	467.0
Breach Base Width (BB, ft)	9.5
Time of Breach Formation (TFH, hr)	0.0
RESERVOIR DESCRIPTION :	
Water Surface Elevation at Time of Breach (HF, ft MSL)	494.0
Top of Dam Crest Elevation (HD, ft MSL)	494.0
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)	0.0
Spillway Gate Center Elevation (HGT, ft MSL)	0.0
Uncontrolled Spillway Discharge Coefficient (CS)	0.0
Spillway Gate Discharge Coefficient (CG)	0.0
	1320.0
Dam Overtopping Discharge Coefficient (CDO)	



SS DAMBRK		· PAGE 5		
	E : Havana East Ash Pond EER : Pond 3B	11/09/2003		
BOUNDARY C	NDITIONS :			
Hydrogr	ph Time Intervals (DHF,)	nr) 0.00		
Routing	Period (TEH, hr)	2.09		
Breach	evelopment Exponent (BREX	0.00		
Mud/Deb	Mud/Debris Flow Parameter (MUD)			
Dry Bed	Dry Bed Routing Parameter (IWF)			
Hydraul	Hydraulic Radius Computation Parameter (KPRES)			
Landsli	e Simulation (KSL)	0 (none		
Critica	Flow Froude Number (DFR)	0.950		
Time				
0.0	0 165.0			
2.0	0 165.0			

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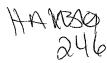
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IOSS DAMBER version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B		PAGE 11/09/2
SUMMARY OF PROGRAM CONTROL PARAMETERS :		
Problem Specification Option (KKN, KUI, MULDAM, IDAM)	13	
Number of Cross-Sections Entered (NS)	4	
Number of Top Widths Entered (NCS)	8	
Number of Cross-Sectional Hydrographs to Plot (NTT)	0	
Flow Type Parameter (KSUPC)	3	(mixed flo
Number of Lateral Inflow Hydrographs (LQ)	0	
Number of Points in Gate Control Curve (KCG)	0	
CHANNEL-VALLEY BOUNDARY CONDITIONS :		
Max Discharge at Downstream End (QMAXD, cfs)		
Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)		0.0
Initial Time-Step Size (DTHM, hr)		-1.
Time at which Dam Starts to Fail (TFI, hr)		0.
Theta Weighting Factor (F1I)		0
Stage Convergence Criterion (EPSY, ft)		0
Downstream Boundary Type Paramter (YDN)		
Slope of Channel Downstream of Dam (SOM, ft/mi)		0.



PROJ	AMBRK ver JECT TITLE JECT NUMBER	: Havana	East Ash P	ond	PAGE 7
CRO	SS-SECTION	NUMBER :	1		
	Cross-Sect	ion Tocati	on (XS(I)	mi)	1.000
	Flooding E				0.000
DOV	NNSTREAM RE	EACH NUMBER	R : 1		
	Roach Cont	raction-Ex	coansion Co	efficient (FKC)	0.000
CR	Minimum Di	istance Bet	ween Inter	polated Cross-Sections (E	OXM, mi) 0.000
	Elevation		Channel Manning	Top	
	(ft MSL)	BS(K,I)	CM(K,I)	(10)	
	467.00 472.00 477.00 482.00 487.00	10.0 20.0 30.0 40.0 50.0 52.0 52.0	0.0400 0.0400 0.0400 0.0400 0.0400 0.0400 0.0400	0.0 0.0 0.0 0.0 0.0 0.0	

F	OSS DAMBRK ve PROJECT TITLE PROJECT NUMBE	: Havana	East Ash	Pond		PAGE 8
	CROSS-SECTIO	N NUMBER :	2			
}	Cross-Sec	tion Locat	ion (XS(I)	, mi)		1.038
П	Flooding	Elevation	(FSTG(I),	ft MSL)		0.000
П	DOWNSTREAM R	EACH NUMBE	R: 2			
	Reach Con	traction-E	xpansion C	oefficient (FKC)	0.000
П	Minimum D	istance Be	tween Inte	rpolated Cro	ss-Sections (DXM, mi)	0.001
	CROSS-SECTIO	N and REAC		ION :		
		Channel Top Width	Manning n	Storage Top Width		
	HS(K,I) (ft MSL)			(ft)		
	466.43	10.0	0.0400			
	466.99 467.00 482.00 487.00 492.00	200.0 200.0 200.0 200.0	0.0400 0.0400 0.0400 0.0400	0.0 0.0 0.0 0.0		
	496.00 498.00	200.0 200.0	0.0400 0.0400	0.0		



S DAMBRK ver: ROJECT TITLE ROJECT NUMBER	: Havana	East Ash P	ond	PAGE 9
CROSS-SECTION	NUMBER :	3		
Cross-Sect	ion Locati	on (XS(I),	mi)	1.070
				0.000
Flooding E	levation (FSTG(I), I	f MSL)	
DOWNSTREAM RE	ACH NUMBER			
Desel Cont	raction-Ex	mansion Co	efficient (FKC)	0.000
Reach Cont	Laction DA			
Minimum Di			polated Cross-Sections (DX	M, mi) 0.001
CROSS-SECTION Elevation HS(K,I)	stance Bet I and REACH Channel Top Width BS(K,I)	DESCRIPTI Channel Manning	polated Cross-Sections (DX ON : Storage Top Width	M, mi) 0.001
CROSS-SECTION Elevation HS(K,I) (ft MSL)	stance Bet N and REACH Channel Top Width BS(K,I) (ft)	DESCRIPTI Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft)	M, mi) 0.001
Elevation HS(K,I) (ft MSL)	Stance Bet N and REACH Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft) 0.0	M, mi) 0.001
Elevation HS(K,I) (ft MSL)	Stance Bet and REACH Channel Top Width BS(K,I) (ft) 10.0 140.0	Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft) 0.0 0.0	M, mi) 0.00:
Elevation HS(K,I) (ft MSL) 465.95 466.99 467.00	Stance Bet and REACH Channel Top Width BS(K,I) (ft) 10.0 140.0	Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft) 0.0 0.0 0.0 0.0	M, mi) 0.00
Elevation HS(K,I) (ft MSL) 465.95 466.99 467.00 472.00	Stance Bet and REACH Channel Top Width BS(K,I) (ft) 10.0 140.0	Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft) 0.0 0.0 0.0 0.0 0.0	M, mi) 0.001
Elevation HS(K,I) (ft MSL) 465.95 466.99 467.00	Stance Bet N and REACH Channel Top Width BS(K,I) (ft) 10.0 140.0 200.0 200.0	Channel Manning n CM(K,I)	polated Cross-Sections (DX ON: Storage Top Width BSS(K,I) (ft) 0.0 0.0 0.0 0.0 0.0 0.0	M, mi) 0.00:

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BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B	PAGE 10 11/09/2001
CROSS-SECTION NUMBER: 4	
Cross-Section Location (XS(I), mi)	1.099
Flooding Elevation (FSTG(I), ft MSL)	0.000
CROSS-SECTION DESCRIPTION :	
Elevation Channel Storage Top Top Width Width HS(K,I) BS(K,I) BSS(K,I) (ft MSL) (ft) (ft)	
465.52 10.0 0.0 466.99 10.0 0.0 467.00 90.0 0.0 472.00 200.0 0.0	

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BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B

11/09/2001

1 3

HR 249

DRAFI

BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B PAGE 12 11/09/2001 DISTANCE BETWEEN INTERPOLATED CROSS-SECTIONS (DXM) THAT WILL BE USED IN COMPUTATIONS Interp. Down Stream Reach Number Cross Section Distance I=1,NS1 DXM(I) (mi) 101.0000 0.0010 0.0010 Total number of cross-sections (original+interpolated) 63 Maximum number of cross-sections allowed 300

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 13

OUTPUT DATA SUMMARY :

CROSS-SECTION and REACH SUMMARY :

Cross Section	Cross Section	Bottom Elevation	Reach Number	Reach Length	Reach Slope	
Number	Location (mi)	(ft MSL)		(mi)	(ft/mi)	
1	1.000	467.000	1	0.038	15.000	
2	1.038	466.430 465.950		0.032	14.999	
3	1.070	465.530	3	0.029	14.828	

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1.3

BOSS DAMBRK version 3.00
PROJECT TITLE : Havana East Ash Pond
PROJECT NUMBER : Pond 3B PAGE 14 11/09/2001 RE-NUMBERED DAM/BRIDGE CROSS-SECTIONS : Dam/ Revised Cross Section Bridge Number of Intermediate Cross-Sections (NN(NS)) 63 Number of Time Steps (NNU) 2

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 15

INITI	AL CONDIT	ONS TABLE :						
Cross Section Number	Cross Section Locatio XI {mi}	Normal Flow	Normal Flow Depth DEPN (ft)	Critical Flow Water Elevation YC (ft MSL)	Critical Flow Depth DEPC (ft)	(dus = 0)	Iteration Count for Computing Nrml Dpth ITN	Computing
			2.29	468.39	1.39	.0	12	
	1 1.0				0.74	0		
	2 1.0 3 1.0							_
	4 1.0	~-						
	5 1.0							_
	6 1.0		1.04			_		
	7 1.0						_	
	8 1.0					_		
	9 1.0	45 467.4				_		
1	0 1.0							12
1	1 1.0					_		
1	2 1.0							
1	1.0							
	1.0							
	1.0							
	1.0		-			. (
	1.0 18 1.0	-	•		0.97			
)55 467.4						
		56 467.4						-
		57 467.4		467.17			•	•
		058 467.4	3 1.30			•	12	•
		59 467.4				•	12	
		060 467.4					1	
	25 1.	061 467.4				•	D 1:	
:		062 467.4					0 1:	
		063 467.4					0 1:	
		064 467.4					0 1	
		065 467.4		_			0 1	
	~ -	066 467.4					0 1	
		067 467.4 068 467.4		-			0 1	
							•	
		069 467. 070 4 67.				_	0 1	
		071 467.		3 467.1		_		2 1 2 1
		072 467.		5 467.1		_	-	2 1
		073 467.				•		2 1
		074 467.	17 1.5			o .		2 1
		075 467.				•		2 1
		076 467.				-		2 1
		077 467.				-		2 1
		078 467.				-		.2 1
		079 467.			•	•		.2
		080 467.						2 1
		.081 467.						.2 1
		.082 467.		_				.2 1
		.083 467.		-			0 1	.2 1
		.084 467.					0	12 1
	49 1	.085 467.	70 T.		•			

	TITLE : I		t Ash Pond			:	11/09/2001	
Cross	Cross	Normal	Normal		Critical			
Section Number	Section Location	Flow Water Elevation		Flow Water Elevation	Flow Depth	(0 = sub)	Count for Computing Nrml Dpth	Computing
I	XI (mi)	YN (ft MSL)	DEPN	YC. (ft MSL)	DEPC	IFR	ITN	ITC
50	1.086	467.50	1.79	467.17	1.46	0	12	13
51	1.087	467.50	1.80	467.17		-		
52	1.088	467.51	1.83	467.17	1.49	0		
53	1.089	467.51	1.84	467.17	1.50	0		
54	1.090	467.51	1.86	467.17	1.52	0		
55	1.091	467.52	1.88	467.18	1.54	0	12	
56	1.092	467.52	1.89	467.17	1.55	0	12	1
57	1.093	467.52	1.91	467.17	1.56	0	12	. 1
58	1.094	467.52	1.93	467.17	1.58	0	12	1
59	1.095	467.52	1.94	467.17	1.59	0	12	1
60	1.096	467.53	1.97	467.17	1.60	0	12	1
61	1.097	467.53			1.62	. 0	12	1
62	1.098	467.54				0	12	1
63	1.099	467.54	2.02	467.17	1.65	0	12	1:

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BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B

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11/09/2001

SUMMARY OF INITIAL DOWNSTREAM BOUNDARY CONDITIONS :

Cross-section Number at Downstream End of Model (IN) Initial Water Surface Elev. at Downstream End (YNN, ft MSL) Initial Flow Depth at Downstream End (DEP, ft) 63 467.538 2.018

COMPUTED STEP BACKWATER TABLE :

Cross Section Number	Cross Section Location	Flow		Backwater Water Surface Elevation	Backwater Water Depth	Iteration Count for Computing Backwater
I	х	QIL		YIL	DEP	ITB
	(mi)	(cfs)		(ft MSL)	(ft)	
						5
62	1.098	100	0.0	467.555	2.020	
61	1.097	100	0.0	467.570	2.021	5
60	1.096	100	3.0	467.584	2.020	5
59	1,095	10	0.0	467.597	2.018	5
58	1.094	10	0.0	467.609	2.015	5
57	1.093	10	0.0	467.620	2.011	5
56	1.092		0.0	467.630	2.006	5
55	1.091		0.0	467.640	2.001	5
54	1.090		0.0	467.649	1.995	5
			0.0	467,657	1.989	5
53	1.089			467.665	1.982	5
52			0.0			5
51	1.087	10	0.0	467.673	1.975	3

I X (π	1.086 1.085 1.084 1.083	QIL (cfs)		YIL	משמ	Backwater
49 48 47 46 45 44 43 42	1.085 1.084 1.083 1.082			(ft MSL)	DEP (ft)	ITB
48 47 46 45 44 43 42	1.084 1.083 1.082		100.0	467.680	1.967	5
46 45 44 43 42	1.082		100.0	467.687 467.693	1.959 1.951	5 5
45 44 43 42			100.0	467.700 467.706	1.942 1.934	5 5
43 42	1.081		100.0	467.711	1.924	5
	1.080 1.079		100.0	467.717 467.722	1.915 1.906	5 5
• •	1.078 1.077		100.0	467.727 467.732	1.896	5
40	1.076		100.0	467.737	1.886 1.876	5 5
39 38	1.075		100.0	467.741 467.746	1.865 1.855	5 5
37 36	1.073		100.0	467.750	1.844	5
35	1.072		100.0 100.0	467.754 467.758	1.833 1.823	5 5
34 33	1.070		100.0	467.762 467.765	1.811 1.800	5 5
32	1.068		100.0	467.769	1.789	5
31 30	1.067 1.066		100.0 100.0	467.772 467.775	1.777 1.766	5 5
29 28	1.065 1.064		100.0	467.779 467.782	1.754	5 5
27	1.063		100.0	467.785	1.730	5
26 25	1.062 1.061		100.0	467.788 467.791	1.718 1.706	5 5
24 23	1.060 1.059		100.0	467.794 467.796	1.694 1.681	5 5
22 21	1.058		100.0	467.799	1.669	5
20	1.057 1.056		100.0	467.801 467.804	1.656 1.644	5 5
19 18	1.055		100.0	467.806 467.809	1.631 1.619	5 5
17 16	1.053		100.0	467.811	1.606	5
15	1.052 1.051		100.0 100.0	467.813 467.816	1.593	5 5
14 13	1.050 1.049		100.0	467.818 467.820	1.568 1.555	5 5
12 11	1.048 1.047		100.0 100.0	467.822	1.542	5
10	1.046		100.0	467.824 467.826	1.529 1.516	5 5
9 8	1.045		100.0	467.828 467.830	1.503 1.490	5 5
. 7 6	1.043		100.0	467.831	1.476	5
5	1.042		100.0 100.0	467.833 467.835	1.463 1.450	5 5
4 3	1.040 1.039		100.0 100.0	467.837 467.838	1.437 1.423	5
2	1.038		100.0	467.840	1.410	5
1	1.000		100.0	494.000	27.000	0
					4004 25	

DAMBRK ver	rsion 3.00 : Havana	East Ash Pond	PAGE 1
OJECT NUMBE			
NITIAL COND	ITIONS :		
Interp.	Initial	Initial	
Cross-	Water	Flow	
Section	Elevation		
1	YI(I)	QDI(I) (cfs)	
	(ft MSL)	(CLS)	
1		100.0	
2	467.84	100.0	
3		100.0	
4	467.84	100.0 100.0	
5	467.83	100.0	
6 7		100.0	
8		100.0	
9		100.0	
10		100.0	
11		100.0	
12		100.0	
13		100.0 100.0	
14		100.0	
15 16		100.0	
17		. 100.0	
18		100.0	
19	467.81	100.0	
20			
21			
22			
23 24			
25		100.0	
26			
27			
28			
29		100 0	
30 31		400 0	
32			
33		100.0	
34	467.76	100.0	
35			
. 36		100 0	
37		400.0	
. 38			
. 3:			
4:			
4:		100.0	
4		100.0	
4			
4			
4	6 467.7	100.0	

HM 257

4.3

Maximum Number of Time Steps Allowed 119	BOSS DAMBRK Ver PROJECT TITLE PROJECT NUMBER	: Havana		Pond		PAGE 20
Interp. Initial Initial Cross-Section Elevation Elevation TY(I) (FT MSL) (cfs) 47 467.70 100.0 48 467.69 100.0 50 467.68 100.0 51 467.67 100.0 52 467.67 100.0 53 467.66 100.0 54 467.65 100.0 55 467.63 100.0 56 467.63 100.0 57 467.62 100.0 58 467.63 100.0 56 467.63 100.0 57 467.62 100.0 58 467.61 100.0 58 467.57 100.0 59 467.57 100.0 60 467.57 100.0 61 467.57 100.0 62 467.57 100.0 63 467.54 100.0 62 467.55 100.0 63 467.57 100.0 60 467.57 100.0 61 467.57 100.0 62 467.57 100.0 63 467.54 100.0 65 100.0 66 100.0 67 100.0 68 100.0 69 100.0 60 100.0 60 100.0 61 100.0 62 100.0 63 100.0 63 100.0 64 100.0 65 100.0 66 100.0 67 100.0 68 100.0 69 100.0 69 100.0 60				<u></u>		
I YI(I) QDI(I) (ft MSL) (cfs)	Interp. Cross-	Initíal Water	Flow			
47 467.70 100.0 48 467.69 100.0 49 467.69 100.0 50 467.68 100.0 51 467.67 100.0 52 467.67 100.0 53 467.66 100.0 54 467.65 100.0 55 467.61 100.0 56 467.63 100.0 57 467.62 100.0 58 467.61 100.0 59 467.60 100.0 60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 64 467.57 100.0 65 467.57 100.0 65 467.58 100.0 66 467.58 100.0 67 467.59 100.0 68 467.59 100.0 69 467.50 100.0 60 467.50 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 64 467.55 100.0 65 467.55 100.0 66 467.55 100.0 67 467.50 100.0 68 467.50 100.0 69 467.50 100.0 60 467.50 100.0 60 467.50 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 64 467.55 100.0 65 467.55 100.0 66 467.55 100.0 67 467.60 100.0 68 467.60 100.0 69 467.60 100.0 60 467.50 100.	I	YI(I) (ft MSL)	QDI(I) (cfs)			
50	47 48	467.70 467.69		100.0 100.0		
52 467.67 100.0 53 467.66 100.0 54 467.65 100.0 55 467.64 100.0 55 467.62 100.0 57 467.62 100.0 58 467.61 100.0 59 467.63 100.0 60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 64 467.57 100.0 65 467.64 100.0 66 467.55 100.0 67 467.56 100.0 68 467.57 100.0 69 467.58 100.0 60 467.59 100.0 60 467.51 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was jost during the routing, a positive value denotes flow volume was gained during the routing, Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00	50	467.68		100.0	•	
Section Sect	52					
55 467.64 100.0 56 467.63 100.0 57 467.62 100.0 58 467.61 100.0 59 467.58 100.0 60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 WITING COMPLETED: Number of Time Steps Used (KTIME) 17 Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) 2. Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
57 467.62 100.0 58 467.61 100.0 59 467.58 100.0 60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 WITING COMPLETED: Number of Time Steps Used (KTIME) Maximum Number of Time Steps Allowed Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
58 467.61 100.0 59 467.60 100.0 60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 WITING COMPLETED: Number of Time Steps Used (KTIME) 17 Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) 2. Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
60 467.58 100.0 61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 OUTING COMPLETED: Number of Time Steps Used (KTIME) 17 Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) 2. Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
61 467.57 100.0 62 467.55 100.0 63 467.54 100.0 OTING COMPLETED: Number of Time Steps Used (KTIME) 17 Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) 2. Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
62 467.55 100.0 63 467.54 100.0 OUTING COMPLETED: Number of Time Steps Used (KTIME) 17 Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) 2. Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
Number of Time Steps Used (KTIME) Maximum Number of Time Steps Allowed Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
Number of Time Steps Used (KTIME) Maximum Number of Time Steps Allowed 119 Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00	V3	107.54		100.0		
Maximum Number of Time Steps Allowed Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
Total Time of Flood Routing (TT, hr) Flood Wave Arrival Time based upon a WSEL Increase of (ft) 1.0 CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00	Number of	Time Step	s Used (Ki	rime)		17
CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00	Maximum Nu	mber of T	ime Steps	Allowed		119
CONSERVATION OF MASS RESULTS: Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						2.
Should be close to 0.00%, a negative value denotes flow volume was lost during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00	Flood Wave	Arrival '	rime based	i upon a WSEL I	Increase of (ft)	1.0
during the routing, a positive value denotes flow volume was gained during the routing. Normalized as a percent of inflow volume, maximum change in conservation of mass during routing was 0.00						
change in conservation of mass during routing was 0.00	during the	routing,	a positiv	re value denote	es flow volume w	as gained
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					へへ	!

BOSS DAMBRK version 3.00 PROJECT TITLE : Havana East Ash Pond PROJECT NUMBER : Pond 3B PAGE 21 11/09/2001

FLOOD	CREST SUMMA	ARY :					
Cross Section	Maximum Stage	Maximum Flow	Time To Maximum	Maximum Flow Velocity	Flood Elevation	Time To Flood Elevation	Flood Wave Arrival Time
Location (mi)	Elevation (ft MSL)	(cfs)	Stage (hr)	(ft/sec)	(ft MSL)	(hr)	(hr)
		16295	0.005	17.30	0.00	0.00	0.00
1.000	494.00	16295	0.080		0.00	0.00	0.02
1.038	477.62 477.60	16206	0.080	8.94	0.00	0.00	0.02
1.039 1.040		16216		8.97		0.00	0.02 0.02
1.040						0.00	0.02
1.041							
1.042			0.080				
1.044							
1.045		16234					:
1.046		16231					
1.047	477.43						
1.048	477.41						
1.049							0.03
1.050							
1.051						0.00	
1.052							
1.053					0.00		
1.054							
1.055				9.43			
1.05							
1.05			0.080				
1.059							
1.060							
1.06							
1.06	2 477.13						
1.06							0.03
1.06							
1.06						0.00	
1.06				_			
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1.06 1.07	-						
1.07			6 0.07				
1.07	-		6 0.07	5 9.2			
1.07						• : .	*
1.07		3 1546			-	-	
1.07					-		
1.07							
1.07					_		
1.07	8 476.8				_		
1.07							
1.08							
1.08						0.0	
1.08				-		0.0	
1.08				_		0.0	0.03
1.08	34 476.6	,, 130	,,				

Hx 259

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FLOOD CREST SUMMARY :

Cross Section Location (mi)		(cfs)	(hr)	(ft/sec)	Flood Elevation (ft MSL)	Flood Elevation	Flood Wave Arrival Time (hr)
	476 61						
1.085							
1.086	476.59	15369	0.085	9.75	0.00	0.00	0.03
1.087	476.56	15369	0.085	9.81	0.00	0.00	0.03
1.088	476.53	15368	0.085	9.87	0.00	0.00	0.03
1.089	476.50	15366	0.085	9.93	0.00	0.00	0.03
1.090	476.47	15365	0.085	10.00	0.00	0.00	
1.091	476.44	15362	0.085	10.07	0.00	0.00	
1.092	476.41	15358	0.085	10.16	0.00	0.00	
1.093	476.37	15354	0.085	10.25	0.00	0.00	0.03
1.094	476.34	15348	0.085	10.36	0.00	0.00	0.03
1.095	476.30	15340	0.085	10.47	0.00	0.00	
1.096	476.25	15330	0.085	10.60	0.00	0.00	0.03
1.097	476.20	15340	0.085	10.75	0.00	0.00	
1.098	476.15	15353	0.085	10.93	0.00		
1.099	476.09	15363	0.085	11.16			

END OF OUTPUT

Slope Stability Analysis Havana Power Station East Ash Pond #3B September 10, 2001 JHK

Slope stability calculations were done with the computer Slope/W produced by Geo-Slope International. The Spencer method of analysis was used.

Because the embankment will be made of highly permeable, sandy soil, and the pond will have an impermeable liner, there will not be any cases where the undrained strength of the sand will control. For all significant load conditions, the embankment will be in the consolidated-drained condition. As shown in other portions of these calculations, any seepage that would get through the liner system would migrate nearly straight down through the embankment until reaching the water table.

Based on these characteristics of the embankment, no rapid drawdown or partial pool analysis was done. The embankment was analyzed for water to the normal operating elevation of 492 feet and ash fill to 492 feet. For each of these, both seismic and non-seismic conditions were analyzed for both low and high water table. This resulted in eight separate cases being analyzed. These are summarized in the table below along with the minimum factor of safety for each case as computed by Slope/W.

Because the clay liner will be only one-foot thick, it was ignored during slope stability calculations. Its primary purpose is seepage control, not strength. For water-filled pond conditions, the clay liner was given no strength. For the ash-filled pond conditions, the clay was given the same strength properties as the ash to simplify data input. Both of these assumptions are on the conservative side. The actual weight of the clay was used on all cases.

The properties for deposited fly ash are typical values for this type of material. The properties for all other soils are from soil tests performed specifically for this project. See the Soil Reports section of these calculations for further information.

The embankment will be made of the on-site sandy soil compacted to 95% of standard Proctor density. The top ten feet of existing material is somewhat loose with a density of a little less than 95% standard Proctor density. During construction, it is likely that this material will consolidate some, but this was ignored when estimating soil properties for the upper foundation layer. The same soil properties were used for the embankment as the upper foundation layer, which is conservative. Compaction to 95% standard Proctor density will actually give slightly better strength. The deeper foundation soils are somewhat denser than 95% standard Proctor density. The properties used for the deeper foundation soils are shown on the lab reports.

The project is in earthquake zone 1. A seismic factor of 0.025 was applied to determine earthquake forces.

140 A+1

Slope Stability Analysis Havana Power Station East Ash Pond #3B September 10, 2001 JHK 14

In all cases without earthquake forces, the factor of safety was greater than 1.5. In all cases with earthquake forces, the factor of safety was greater than 1.0. Therefore, it was concluded that the embankment has adequate strength. It should also be noted, that in all the cases the minimum factor of safety was associated with slips on the downstream face of the embankment that did not penetrate to the upstream face. The graphical output shows the slip surface associated with the minimum factor of safety.

The full printout for a Slope/W run is quite large. To avoid printing a lot needless pages in this report, only sample pages are included. Full program output can be provided if needed. The following sheets contain summary information for the slope stability analysis. The content of these pages is as follows:

- 1. Table of analyzed conditions and corresponding factor of safety.
- 2. Summary of soil properties
- 3. Summary of ground water elevations.
- 4. Sketch of embankment geometry
- 5. Graphical computer summary of each load case.
- 6. First and last page from a typical analysis printout.

HA 262

Slope Stability Analysis **Havana Power Station** East Ash Pond #3B

September 10, 2001

ЈНК

Summary of Analysis Conditions

Analysis Case

	1A	1B	2A	2B	3A	3B	4A	4B
Factor of Safety	1.56	1.57	1.62	1.50	1.61	1.52	1.61	1.48
Water-filled pond	X	\mathbf{x}	X	\mathbf{x}				
Ash-filled/pond by					\mathbf{X}_{2}	X	X	X
No seismic factor	X		X		X		X	
Seismic factor applied		X		X		X		$ \mathbf{X}_{i} $
High ground water elevation	X	X			X	X		
Lowiground water elevation		10-10-14	\mathbf{X}	X			\mathbf{X}	$ \mathbf{X} $

Soil Properties;

Deep Foundation Soils

Density 118.7 pcf Phi Angle

Cohesion

34 degrees 0.0

Shallow Foundation Soils

Density And Embankment Phi Angle 103.7 pcf

26 degrees 0.0

Cohesion

Clay Liner

Density

118.7 pcf

Phi Angle Cohesion

N/A N/A

Ash

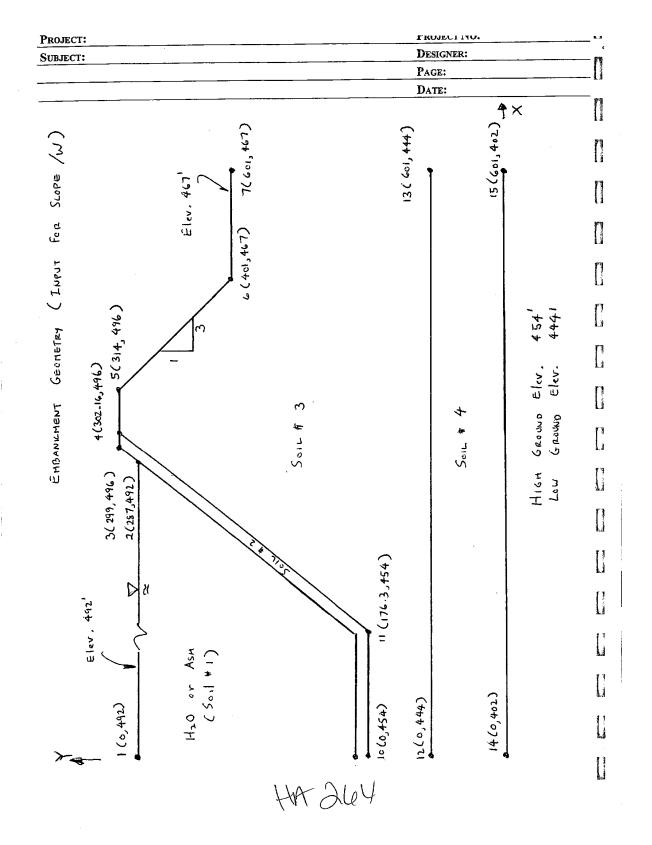
Density

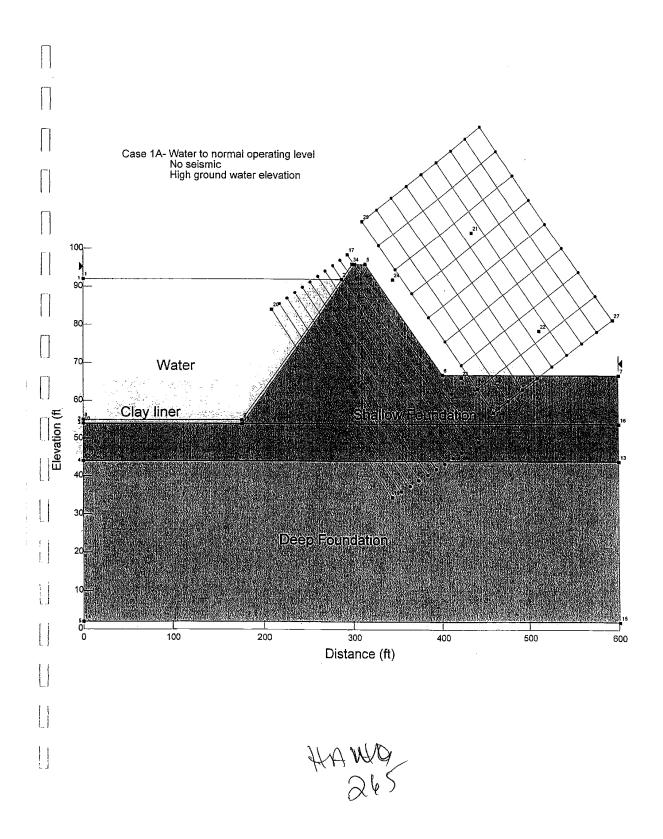
90 pcf (saturated weight)

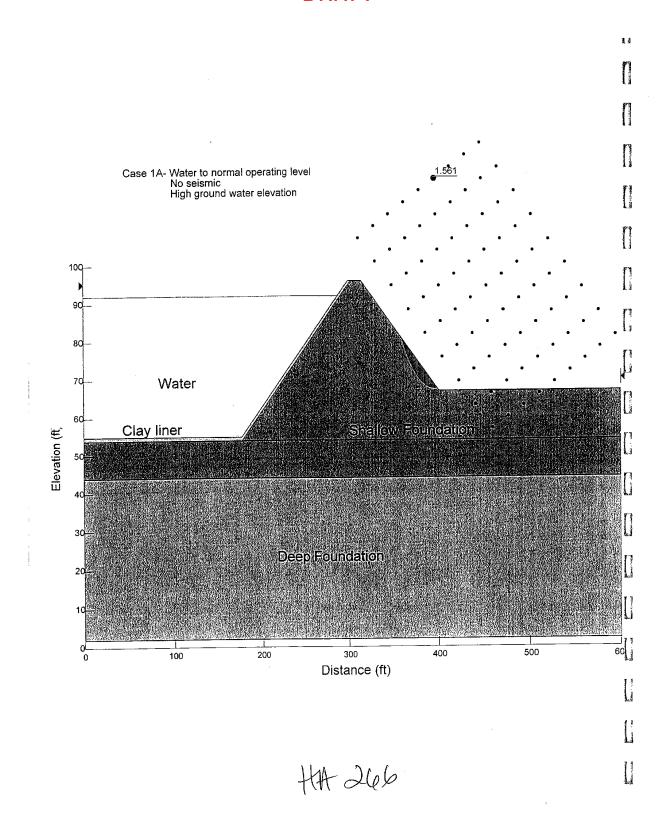
Phi Angle

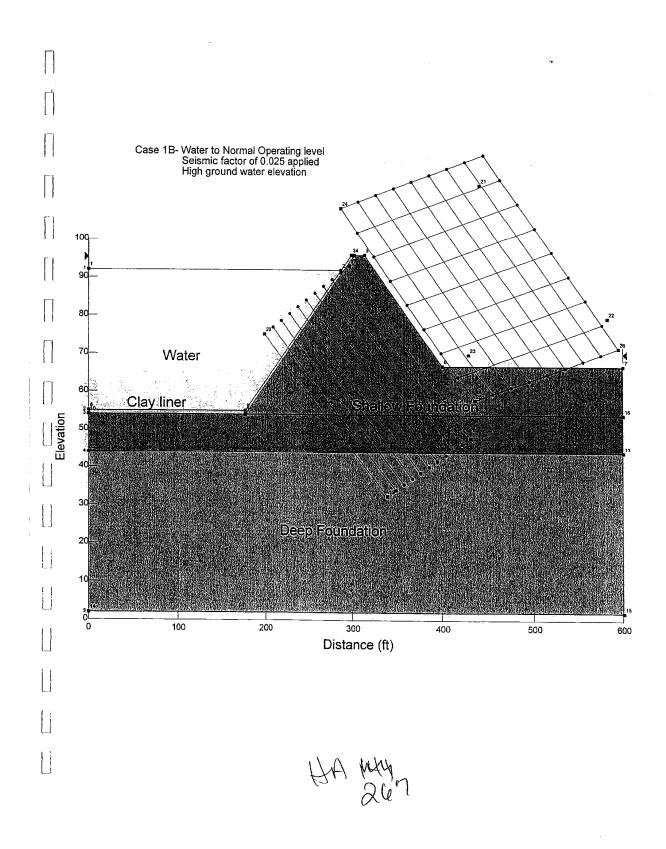
20 degrees

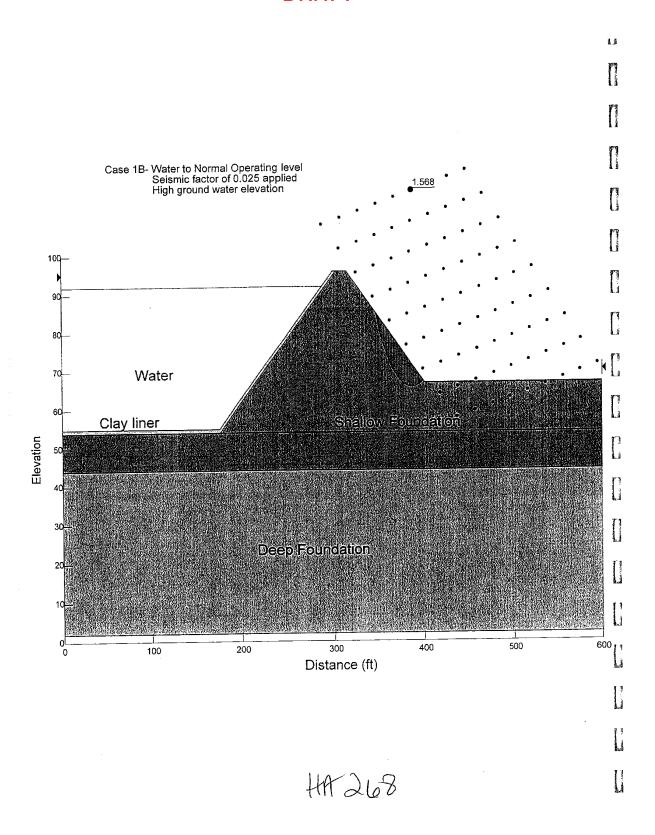
Cohesion 0.0

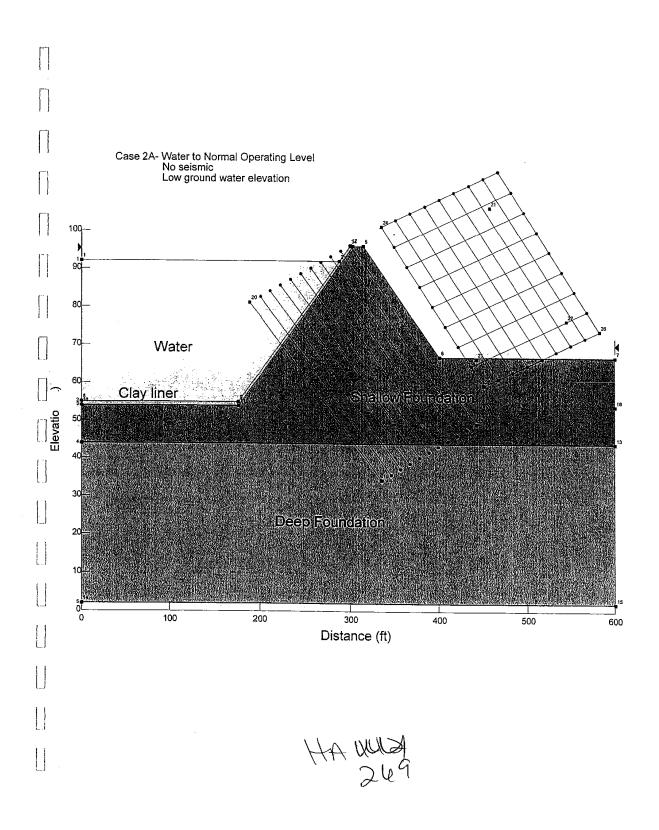


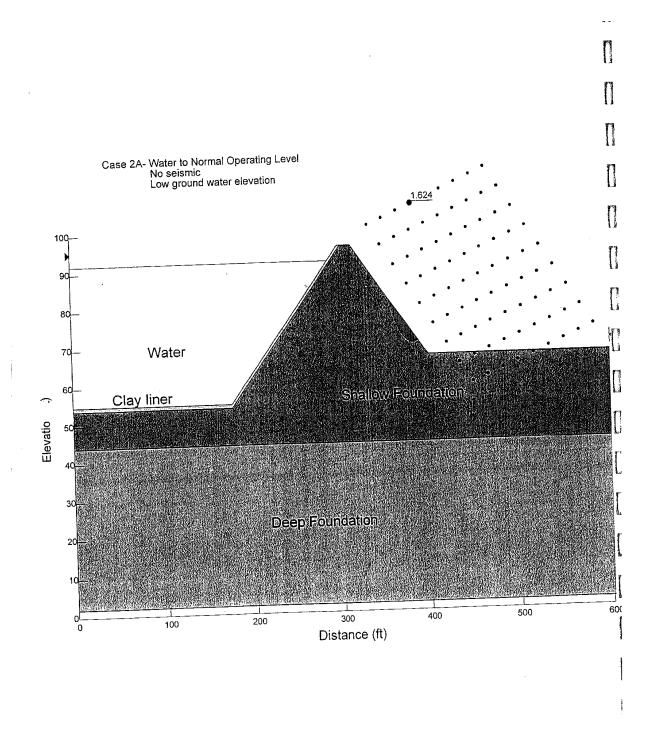




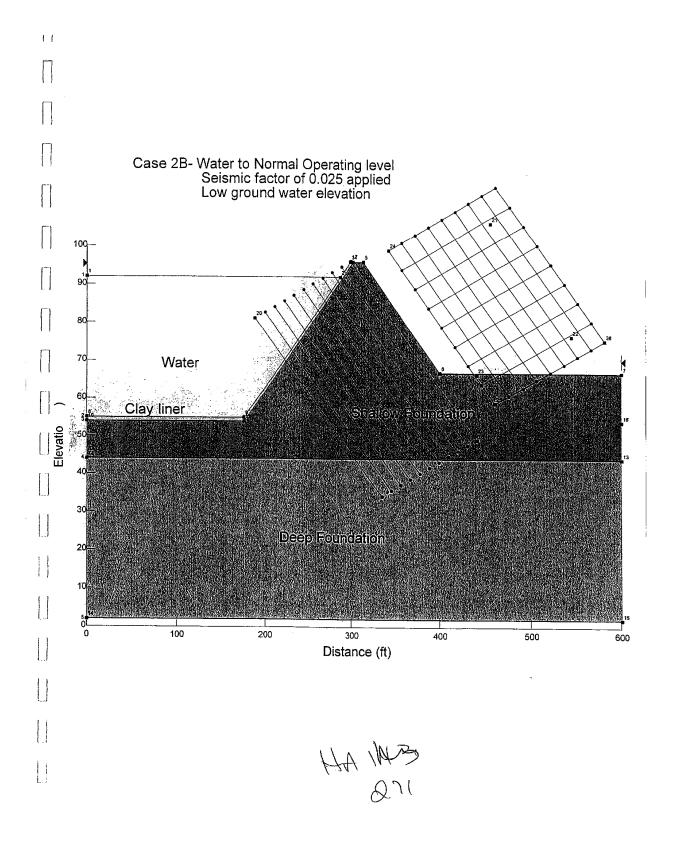


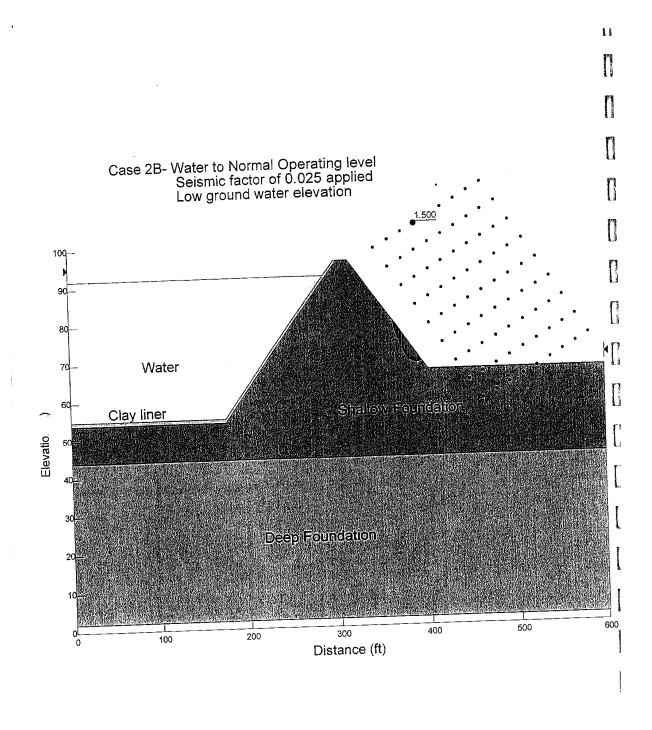




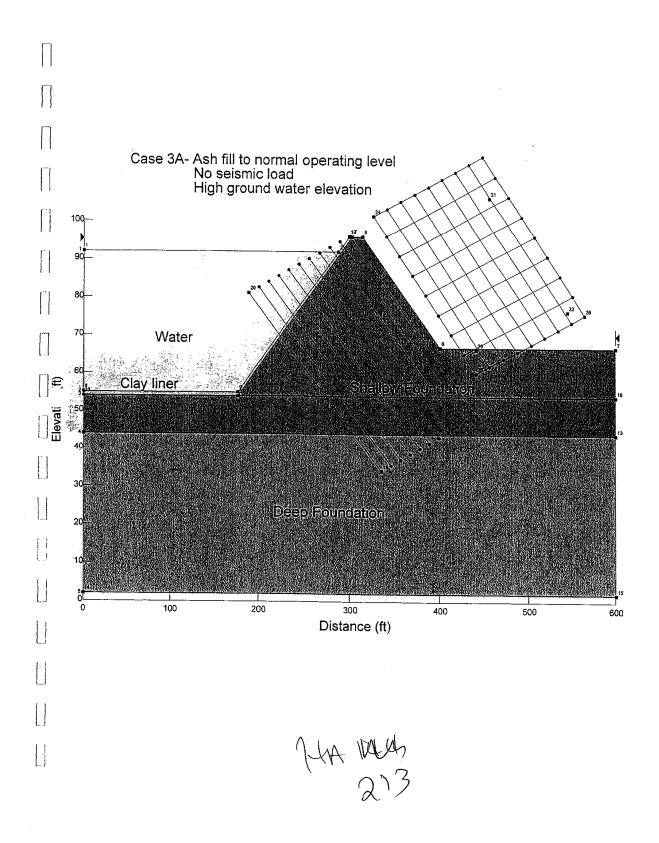


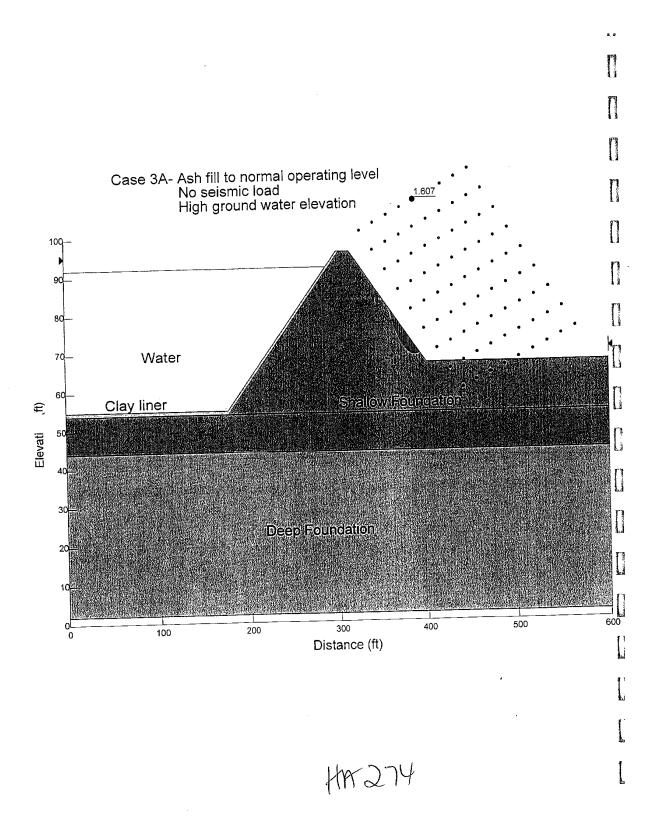
HA 270

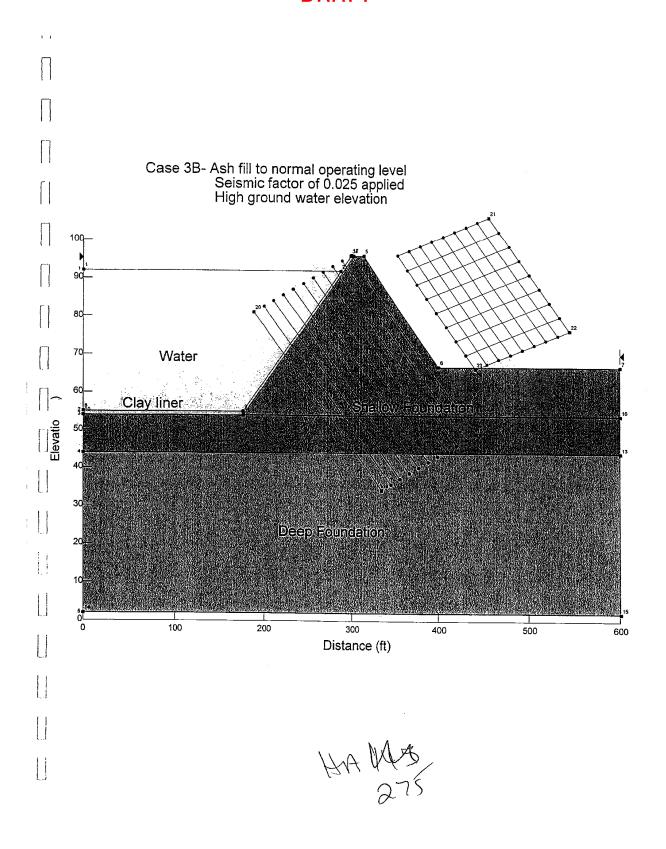


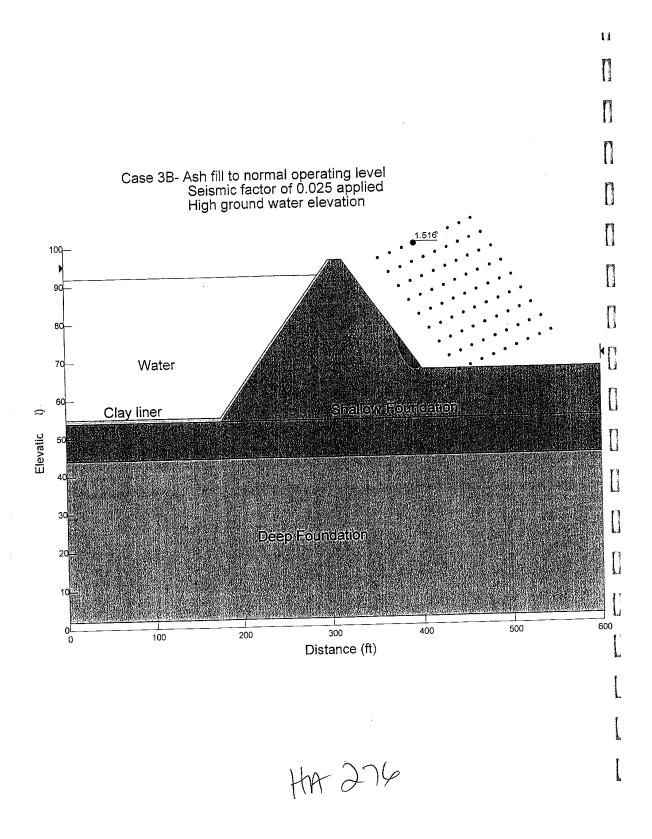


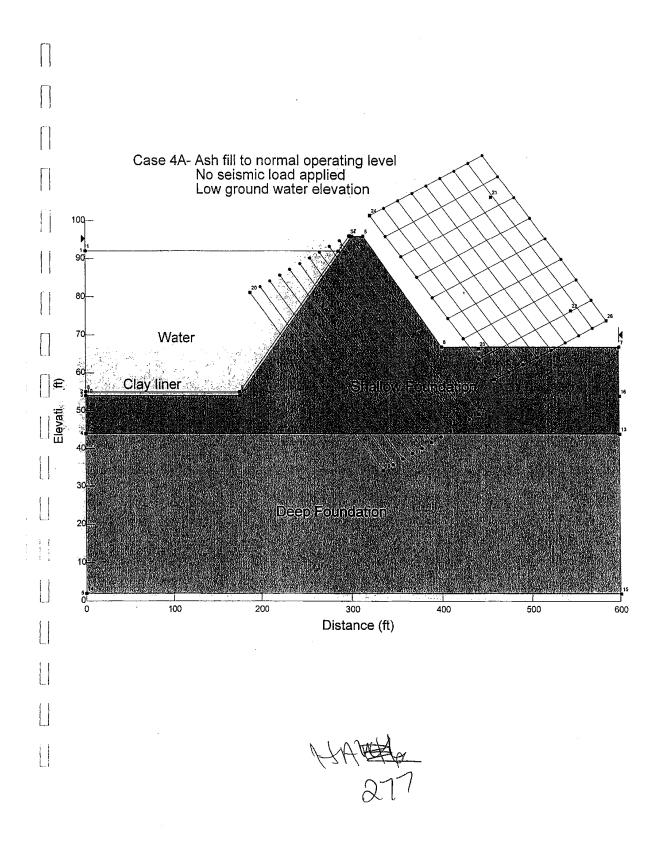
HA 272

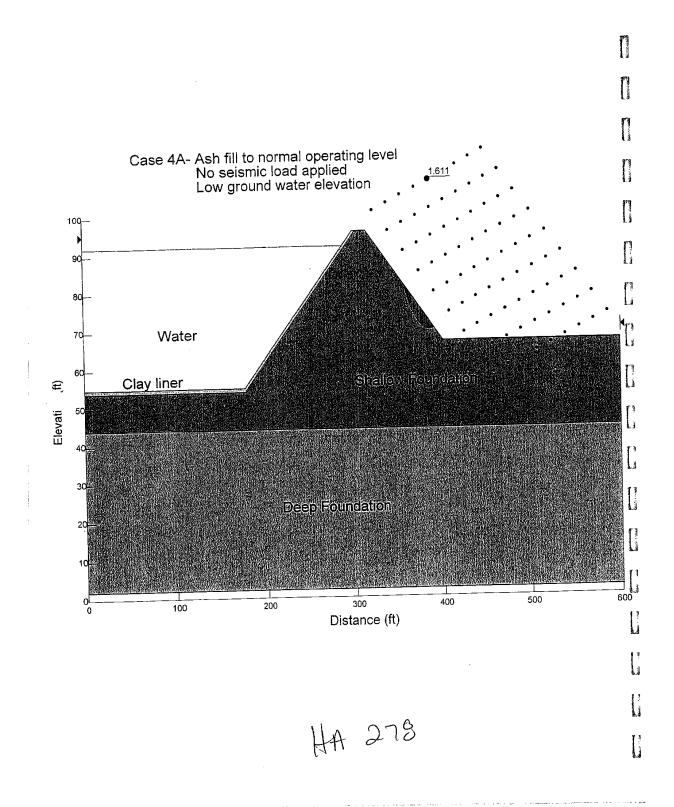


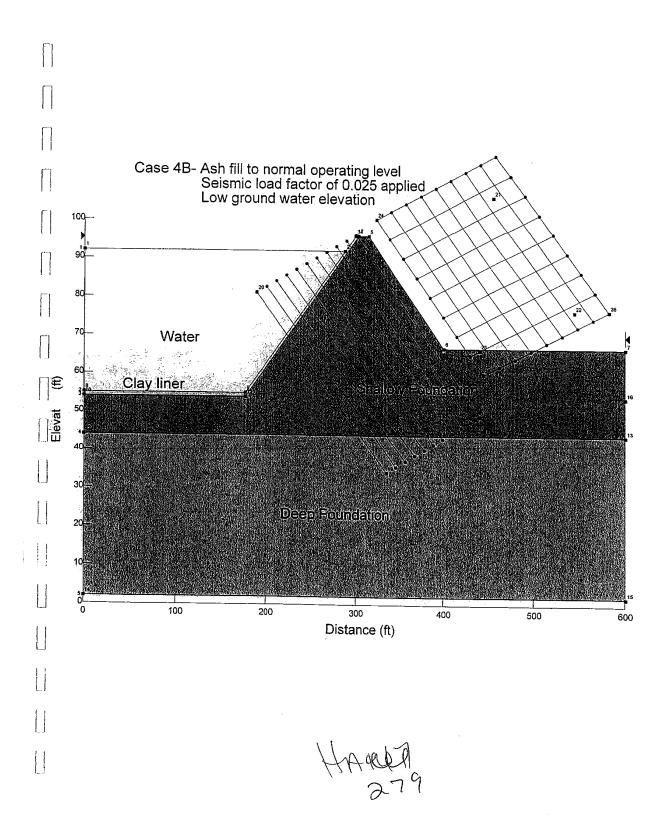


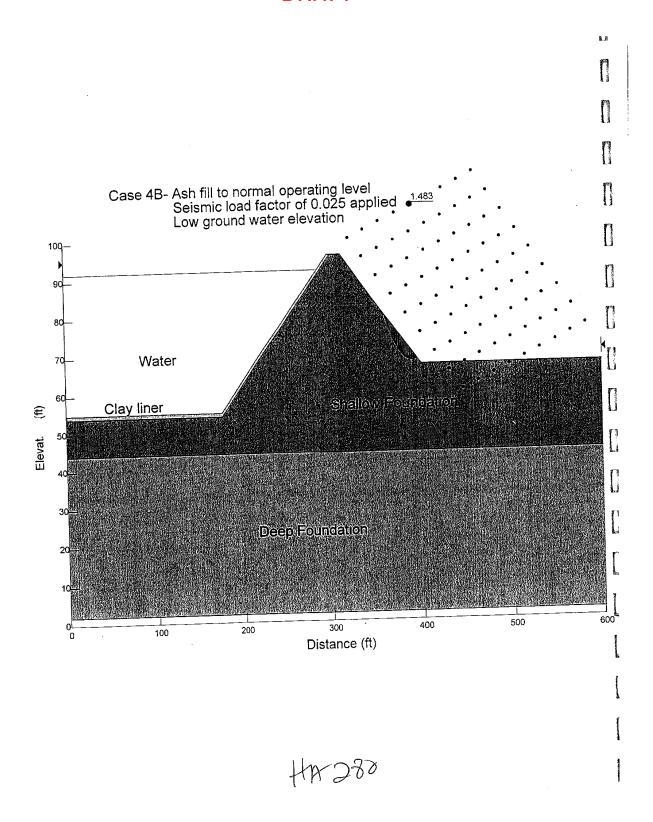












BORING NO. 8-01 DATE 6-27-01 W. & A. FILE NO. 1656 SHEET 1 05 34	2406 West PEORIA,	ORPORATE Nebrask	e Avenue IS 6160	4		RING	
PROJECT ILLINOIS POWER ASH POND EXTER BORING LOCATION See Plot Plan Sheet	KSION		LOC/	ATION H	vana,	Illin	ois
BORING TYPE Hollow-Stem Auger	1A/E A T	WED COM	_ DRIL	Partly	Cloud	ly & M	ild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.	SEEP	AGE WAT	ER ENCOL	INTERED A	T ELEVAT	ION	450.
GROUND SURFACE ELEVATION 467.8 BORING DISCONTINUED AT ELEVATION 406.8				ION AT		- nno. <u></u>	452. 449.
DESCRIPTION	DEPTH			1	MPLETIO		
	IN FEET	SAMPLE TYPE	N	Qp	Qυ	Dø	M
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	- B"						
		SS	9	-	-	-	14
	4 -					-	
		SS	10	-	-	-	13
Medium-Density, Light Brown, Fine- Grained SAND	- 8 -	SS	15	ļ <u>-</u>			3
	F						
		SS	14	-	_	-	3
	-12-						
	_	SS	13	-	-	-	4
		SS	12			_	4
	- 16−		12		_		
Loose, Light Brown, Fine-Grained	- =						
SAND	-20-		L				
		SS	5	-	-	-	17
	-24-						
·		SS	8	-	-	-	-
I - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE I - SHELBY TUBE SAMPLE		Qu - UN Dd - NA	CONFINEI TURAL DE	O COMPRE NY DENSIT DISTURE C	METER RE SSIVE STF / - P.C.F. ONTENT -	RENGTH -	- T.\$.F.

BORING LOG BORING NO. B-01 6-27-01 DATE (CONTINUATION) 34 2 Illinois Power Ash Pond Extension Havana, Illinois SHEET OF 1656 W. & A. FILE NO. SAMPLE TYPE DEPTH IN FEET Ν Qр Q_{u} Dσ DESCRIPTION See Sheet 1 of 34 30 SS 10 34 Medium-Density, Light Brown, Fine-19 To Coarse-Grained SAND And Fine-SS Grained GRAVEL 38 SS 25 42 SS 25 46 50 SS 26 54 SS 28 Q_p - calibrated penetrometer reading - t.s.f. Q_u - unconfined compressive strength - t.s.f. D_d - natural dry density - p.c.f. M_c - natural moisture content - %N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE WHITNEY & ASSOCIATES -

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PROJECT Illinois Power Ash Pond Extens OCATION Havana, Illinois	sion			SHEET_	3	6-27	
· · · · · · · · · · · · · · · · · · ·	1	Ta		W. & A. F	TLE NO.		
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	1
See Sheet 2 of 34							
	-						
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND	_60	SS	29	-	_	_	
EXPLORATORY BORING DISCONTINUED	-					:	
	_64				1		
	_68						
	_72			-			
	76						
	80						
	_					:	
	84		٠	:			
				ENETROM COMPRESS DENSITY -			

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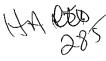
BORING NO.B-02 DATE 6-26-01 WAA FILE NO. 1656	2406 West PEORIA,	Nebraska Nebraska	Avenue		во	RING	LOG
4 or 34	VCTON			TION HE	evena.	Tllin	ois
PROJECT ILLINOIS POWER ASH POND EXTE	NOTON		LOCA	ED BY F	∍hl		
BORING LOCATION See Plot Plan Sheet BORING TYPE Hollow-Stem Auger	NAZE A T	HED COM	DHILL	Partl	y Cloud	iy & M	ild
SOIL CLASSIFICATION SYSTEM U.S.B.S.C.	SEEP	AGE WATE	R ENCOU	NTERED A	T ELEVAT	ION	448.5
GROUND SURFACE ELEVATION 466. 7	GROU	IND WATE	RELEVAT	ON AT	24+(P	HRS	<u>451.2</u>
BORING DISCONTINUED AT ELEVATION 435.7	GROL	IND WATE	R ELEVAT	ION AT CO	MPLETIO	N	<u>450.5</u>
DESCRIPTION	DEPTH IN FEET	SAMPLE	N	Qp	Qu	Dd	Мс
		TYPE	-	 			
Brown SANDY LOAM	_ 3*			·	İ		
Medium, Dark Brown SANDY CLAY				ł		}	
		SS	19	1.1	0.8	112	9
Medium-Density, Brown, Fine-Grained	- 5			<u> </u>		<u> </u>	-
SAND With Considerable Silty Clay		SS	19				11
	_						
Medium-Density, Light Brown, Fine-		 		ļ ——			
Grained SAND	<u> </u>	SS	18	 		ļ <u>-</u>	4
					İ		!
•	-10-		20	 			4
		SS	20	 			
	-						
Loose, Light Brown, Fine-Grained		SS	9	_	-	-	4
SAND							
	L15-				 		
		SS	10_		<u> </u>		6
	L						
•				ľ			
	-20-	55	10				17
		55	10	 			*/-
	-						
Medium-Density, Light Brown, Fine-							
To Medium-Grained SAND							
	-25-					L	ļ <u>-</u>
		_SS	13	<u> </u>			<u> </u>
				1			1
	\vdash						
·	_						
Medium-Density, Light Brown, Fine-							1
To Medium-Grained SAND And Fine-	-30-			 		_	
Grained GRAVEL		SS	16				
EXPLORATORY BORING DISCONTINUED	1						Į.

Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - %

WHITNEY & ASSOCIATES
PEORIA, ILLINOIS

N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE

W. & A. FILE NO. 1656 SHEET 5 OF 34	2406 West EORIA,	ASS ORPORATED Nebraska	Avenue		во	RING	LOC
PROJECT ILLINOIS POWER ASH POND EXTEN BORING LOCATION See Plot Plan Sheet			LOCA	Fe Fe	avana, ehl	· · · · · · · · · · · · · · · · · · ·	
BORING TYPE Hollow-Stem Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C. GROUND SURFACE ELEVATION 466.9 BORING DISCONTINUED AT ELEVATION 435.9	_ SEEP	HER COND AGE WATE IND WATER	R ENCOU R ELEVAT	NTERED A	TELEVAT	ON	451 455 454
DESCRIPTION	DEPTH IN FEET		N	Qв	Qu	Da	N
Brown, Fine-Grained SAND With Some Organic Vegetation Medium-Density, Light Brown, Fine-	5*	ITPE					
Grained SAND		SS	18		-	-	
	- 5 -	SS	17	-	-	-	
		SS	12	-	-	-	
	-10-	SS	13	-	-	-	
Loose, Light Brown, Fine-Grained SAND		SS	10	-	-		_
	15	SS	8	_	-	-	10
Loose, Orange-Brown, Fine- To Medium-Grained SAND	<u> </u>						
		SS	7	-	-	-	
Medium-Density, Orange-Brown, Fine- To Medium-Grained SAND	-25-						
	-23-	SS	20	-			
Medium-Density, Gray-Brown, Fine- To Coarse-Grained SAND	_ _30_						
EXPLORATORY BORING DISCONTINUED		SS	28	 	_	 _	-
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	<u> </u>	Da - NA i	UHAL DE	PENETRO COMPRE Y DENSIT DISTURE C	Y ~ P.C.F.		T.S.F. T.S.F



BORING NO.B-04 DATE 6-25-01 V. & A. FILE NO. 1656 P	2406 West EORIA,	ORPORATEC Nebraska	Avenue S 6160	4	ВО	RING	
DOUBLE TELLINOIS POWER ASH PUND EXIEM	SION		LOC	ATION H	avana,	Illin	ois
ORINGLOCATION See Plot Plan Sheet ORING TYPE Hollow-Stem Auger			DRIL	Partl	Cloud	1y & M:	ild
ORING TYPE ROTTOW-Stell Rage! OIL CLASSIFICATION SYSTEM U. S. B. S. C.	SEEP	AGE WATE	R ENCOL	JNTERED A	T ELEVAT	ION	449.5
ROUND SURFACE ELEVATION 466.0	_ GROL	ND WATE	R ELEVAT	ION AT	24+	_ HRS	- 451.9 CA
ORING DISCONTINUED AT ELEVATION 405. 0			R ELEVA	TION AT C	OMPLETIO	N	
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	Mc
Brown SANDY LOAM Organic Topsoil Soft, Brown And Dark Brown SANDY LOAM	8"						
		SS	5	0.5	0.4	110	11
	4						
Medium, Brown SANDY CLAY LOAM				-	ļ. <u> </u>	 	
		SS	15	1.2	0.9	114	13
Loose, Brown, Fine- To Medium- Grained SAND	\vdash	SS	7	 		-	5
brained Samu	8 -			 			
Loose, Light Brown, Fine- To		SS	6	-	-	-	12
Medium-Grained SAND				 			
	-12-			}			
		SS	5	_	_	_	19
		22					
		SS	5		_	_	18
	- 16−	55		 -			10
	├						
Very Loose, Brown, Fine- To Medium-							·
Grained SAND With Some Silty Clay	-20-						
	20	SS	3	-	,	-	22
Very Loose, Light Brown, Fine- To Medium-Grained SAND	_ _24_	66					
		SS	2	-	-	-	-
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES T - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE		Qu - UNC	ONFINED	PENETRO COMPRE Y DENSITY DISTURE C	SSIVE STR ' - P.C.F. ONTENT -	ENGTH - '	C.S.F.

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B~U4	RING L				DATE	6-25	- 7
PROJECT Illinois Power Ash Pond Exten	sion				7 ILE NO		
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D.d	١
See Sheet 6 of 34							
	_ 30	SS	4	_	-	-	
	34	SS	3	_	-	-	
Medium-Density, Light Brown, Medium- To Coarse-Grained SAND And Fine- Grained GRAVEL	38						
Grained GRAVEL	42	SS	26	-	-	-	
Medium-Density, Light Brown And Gray-Brown, Fine- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL	46	ss	23	-	-	-	
`	_ 50	SS	25	-	-	_	
	_						
	_ 54	SS	20	_	_	_	

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ROJECT Illinois Power Ash Pond Extension OCATION Havana, Illinois					SHEET8 W. & A. FILE NO		34 556
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Dø	Мс
See Sheet 7 of 34							
ledium-Density, Gray-Brown, Medi 'o Coarse-Grained SAND And Fine- brained GRAVEL		SS	20	_	-	-	-
EXPLORATORY BORING DISCONTINUE			-				
	_ 64						
	68						
	_ 72						
	_ 76			7 000		THE PARTIES.	T T T T T T T T T T T T T T T T T T T
	_ 80						
	84				14000		

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WHITNEY & ASSOCIATES BORING NO.B -05 **BORING LOG** DATE 6-27-01 2406 West Nebraska Avenue W. & A. FILE NO. 1656 PEORIA, ILLINOIS 61604 SHEET 9 OF 34 PROJECT ILLINOIS POWER ASH POND EXTENSION LOCATION Havana, Illinois BORING LOCATION See Plot Plan Sheet DRILLED BY Fehl WEATHER CONDITIONS Partly Cloudy & Mild BORING TYPE Hollow-Stem Auger SEEPAGE WATER ENCOUNTERED AT ELEVATION 452. 1 SOIL CLASSIFICATION SYSTEM U.S.B.S.C GROUND WATER ELEVATION AT 24+ 456.2 CAVE IN GROUND SURFACE ELEVATION . 466.9 _ HAS. _ 405.9 451.1 BORING DISCONTINUED AT ELEVATION GROUND WATER ELEVATION AT COMPLETION DESCRIPTION Dσ Мс Brown SANDY LOAM Organic Topsoil 4" Loose, Brown, Fine-Grained SAND With Considerable Silty Clay SS 10 107 13 Medium, Brown SANDY CLAY LOAM SS 12 0.7 0.5 100 20 Loose, Light Brown, Fine-Grained SS 8 8 8 5 14 - 12-SS 8 16 Loose, Light Brown, Fine- To SS 10 Medium-Grained SAND 19 -16-Loose, Brown, Fine-Grained SAND With Some Silt 20-SS 9 24-Loose Brown, Fine- To Medium-Grained SAND With Some Coarse-Grained Sand SS 8 N - BLOWS DELIVERED PER FOOT 8Y A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - % - WHITNEY & ASSOCIATES -



BORING LOG 6-27-01 BORING NO.B-05 DATE (CONTINUATION) 34 10 Illinois Power Ash Pond Extension OF 1656 SHEET PROJECT Havana, Illinois W. & A. FILE NO. DEPTH SAMPLE IN FEET TYPE Мс $Q_{\boldsymbol{u}}$ D^d Q_{P} DESCRIPTION See Sheet 9 of 34 Medium-Density, Light Brown And Brown, Fine-Grained SAND 30 SS 15 34 SS 20 38 21 SS **4**2 Medium-Density, Brown, Medium- To SS 16 Coarse-Grained SAND 46 Medium-Density, Brown, Medium- To Coarse-Grained SAND With Some Fine-Grained Gravel 50 SS 18 Medium-Density, Brown, Medium- To 54 Coarse-Grained SAND 21 SS Qp - CALIBRATED PENETROMETER READING - T.S.F.
Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F.
Dd - NATURAL DRY DENSITY - P.C.F.
Mc - NATURAL MOISTURE CONTENT - % N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE - WHITNEY & ASSOCIATES -

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BORING NOB-05 PROJECT Illinois Power Ash Pond Extocation Havana, Illinois	tension	inuation) on			DATE 11	OF_	34
LOCATION MEVERA, IIIINOIS	W. & A. 8		1636				
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qρ	Qu	D₫	Τ
See Sheet 10 of 34							Ī
	_						
	_60	SS	23	_	_	_	
EXPLORATORY BORING DISCONTINUED							\downarrow
LAI BORATORY BORTAD PIGGORYTHOED							
	_64						
	-						
	68						
·							
	_ 72						
	- 76						
						,	
	80						
	~						
	- 1						
	- 84				:		
·							
FALLING 30 INCHES	Q	p - CALIBE	RATED PE	ENETROME OMPRESSI DENSITY - I	TER READ	 ING - T.S. GTH - T.S	.F.
S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	 D M	d - NATUR lc - NATUR	AL DRY I	TONE CON	P.C.F. TENT - % HITNEY PEOI		

TE	406 West ORIA, I	Nebraska	Avenue			RING I	
EET TOTAL POWER ASH POND EXTENS	ION		LOCA	TION Ha	vana,	lilino	
See Plot Plan Sheet RING LOCATION Hollow-Stem Auger RING TYPE U.S.B.S.C. ULCLASSIFICATION SYSTEM 460.6	WEATI SEEPA	GE WATE	DITIONS _ R ENCOU! R ELEVAT!	NTERED A	T ELEVAT	ON	11d 149.4 451.3 448.8
RING DISCONTINUED AT ELEVATION	DEPTH	SAMPLE	N	Qp	Qu	Da	Mc
DESCRIPTION	IN FEET	TYPE		 -			
rown SANDY LOAK ledium-Density, Light Brown, Fine- irained SAND	8-	SS	12		-		6
		20					
.oose, Light Brown, Fine-Grained	<u> </u>	SS_	7	<u> </u>	-		3
Very Loose, Brown, Fine-Grained SAND		SS	4	-	-	-	18
	-10-	SS	3_	-	-	-	18
Loose, Brown, Fine-Grained SAND	-	SS	7			-	19
	-15-	SS	9			-	-
Medium-Density, Brown, Fine-Grained							
SAND	0.0					L	
	-20-	SS	12	-	<u> -</u>		-
	-25-	SS	13			-	-
Medium-Density, Brown, Medium- To Coarse-Grained SAND And Fine- To	30-						
Medium-Grained GRAVEL		SS	23		<u> </u>	 - -	+
EXPLORATORY BORING DISCONTINUED							
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Qu - U	NCONFINI	D PENETR ED COMPR PRY DENSI MOISTURE	ESSIVE S FY - P.C.F. CONTENT	- %	- T.S.F. - T.S.F.

W. & A. FILE NO. 1656 SHEET 13 OF 34	ORIA,		a Avenue IS 6160	4	ВО	RING	LOC
PROJECT ILLINOIS POWER ASH POND EXTEN: BORING LOCATION See Plot Plan Sheet BORING TYPE HOllow-Stem Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C.	_ WEAT	AGE WATE	DRILI DITIONS	Partly	T ELEVAT	dy & M.	. Id 451
GROUND SURFACE ELEVATION 470. 0 BORING DISCONTINUED AT ELEVATION 439. 0	GROU	IND WATE	RELEVAT	ON AT CO	24+(P	HRS	452 451
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qpi	Qu	Dd	M
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	1 -					ŀ	
		SS	5	-	-	102	14
Medium, Brown SANDY LOAM	_ 5 _	SS	6	0.8	0.5	100	14
Loose, Brown, Fine-Grained SAND							
		SS	4	-	-		14
·	10-	SS	4	_	-		13
		-					
age. S		SS	6		-	-	E
Loose, Brown, Fine- To Coarse- Grained SAND	—15 —	SS	6	_	_	_	4
Loose, Brown, Fine-Grained SAND	_						
	-20-	SS	4		_	_	19
	_						
	-25 -						
		SS	7	-	-	-	
Medium-Density, Brown, Fine-Grained SAND	- -30 -	SS	17				
EXPLORATORY BORING DISCONTINUED		- <u>- 22</u>	1/_				
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Dd - NAT	CONFINED	PENETRO COMPRE Y DENSITY	SSIVE STF ! - P.C.F.	RENGTH -	T.S.F. T.S.F.

PE 6-28-01 PE	406 West ORIA, I	ASS DRPORATED Nebraska LLINOIS	Avenue \$ 61604			RING L	
OJECT ILLINOIS POWER ASH FORD EXTERE	ION			ION Ha	пı		
RING LOCATION See Plot Plan Sileet		UEB COND	TIONS	Lartty	CTOUG	y & Mi	.1d
IRING TYPE Hollow-Stem Auger IL CLASSIFICATION SYSTEM U.S.B.S.C.	SEEPA	GE WATER	RENCOUN	ITERED AT	ELEVATI	ON	51.4 65.1 CAV
OUND SUBSACE ELEVATION							53.8 II
PRING DISCONTINUED AT ELEVATION 443.6	GROU DEPTH	ND WATER				Dd	Mc
DESCRIPTION	IN FEET	TYPE	N	Qp	Qu		
Brown SANDY LOAM	3*						
oose, Light Brown, Fine-Grained							
SAND With Some Silty Clay		SS	6	-			8
	- 5 -	SS	6	-		-	6
	 	30					
							8
	<u> </u>	SS	5			-	
	 10-						
	10	SS	6		_=_		9
Loose, Light Brown, Fine- To Medium-		SS	9	-		-	4
Grained SAND							
Medium-Density, Light Brown, Fine-	-15-	SS	16	_	-		5
Grained SAND			_10				
	L						
	_20-				<u> </u>	<u> </u>	
		SS	16	<u> </u>	_ -	-	18
				ļ			
·				ļ			
Loose, Light Brown, Fine-Grained	25-	 		 		 _	 -
SAND		SS	_8_	 -	 		
	L						
							1
	-30-	SS	10				
EXPLORATORY BORING DISCONTINUED							
	J		LIBRATE	DENETE:	L	FADING -	T.S.F.
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE S T - SHELBY TUBE SAMPLE		Qu - UN	LIBRATEC ICONFINE TURAL DI TURAL M	D COMPR RY DENSIT	ESSIVE SI Y - P.C.F. CONTENT	- %	T.S.F.

HW 294

PE 945 05 34	406 West	& ASS CORPORATED Nebraska ILLINOI	Avenue S 61604	.		RING	
PROJECT ILLINOIS POWER ASH POND EXTENS	ION		LOCA	TION Ha	vana,	Illino	is
BORING LOCATION See Plot Plan Sheet	- 		DBILL	FORY Fe	hl		
BORING TYPE Hollow-Stem Auger SOIL CLASSIFICATION SYSTEM U.S. B.S.C.				Partly			1 <u>10</u>
GROUND SURFACE ELEVATION 488. 7				NTERED A			77
BORING DISCONTINUED AT ELEVATION 427.7				ION AT CO			68
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	N
Brown SANDY LOAM Loose, Brown, Fine-Grained SAND With Some Silty Clay	4"						
		SS	6	-	-	-	E
	- 4 -						
	ļ	SS	7		-	-	5
Loose, Brown, Fine-Grained SAND							
	8 -	SS	6		-	-	6
4**		SS	6	 	_		5
		33	-	<u> </u>			
	-12-	00			<u> </u>		6
·		SS	8		-	-	6
	-16-	SS	10		_	_	
	10	:					
Medium-Density, Light Brown, Fine-							
Grained SAND	-20-	SS	15	-	-	-	4
	_						
	-24-						
	44	SS	18	_	_	_	2
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE	L.,	Dd - NA	TURAL DE	PENETRO D COMPRI RY DENSIT	Y - P.C.F.		T.S.F • T.S.I

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6-26-01 **BORING LOG** BORING NO.B-09 DATE _ (CONTINUATION) 34 PROJECT Illinois Power Ash Pond Extension LOCATION Havana, Illinois 16 ^{OF} 1656 SHEET . W. & A. FILE NO. Мс Dα DEPTH SAMPLE IN FEET TYPE Qu Qp Ν DESCRIPTION See Sheet 15 of 34 _30 25 SS 34 Medium-Density, Light Brown, Fine-SS 16 To Medium-Grained SAND 38 26 SS Medium-Density, Light Brown, Fine-Grained SAND 24 SS 46 Medium-Density, Light Brown, Fine-Grained SAND With Fine-Grained <u>Gr</u>avel Medium-Density, Light Brown, Medium-SS 26 To Coarse-Grained SAND - 54 28 SS Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - % N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE - WHITNEY & ASSOCIATES

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DODING NOR-114	ORING L				DATE	06-26	-01
PROJECT Illinois Power Ash Pond Exte	nsion			SHEET _ W. & A. F	— °F 1556		
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D₫	
See Sheet 16 of 34							
Dense, Light Brown, Medium- To Coarse-Grained SAND With Fine- Grained Gravel	-60	SS	31	-	-	-	
EXPLORATORY BORING DISCONTINUED							-
	_64						
	_68			·			
	-						
	- 72						
					i		
	- 76						
	⊢ 80						
	-					·	
	- 84						
I - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	<u> </u>	P - CALIB	RATED P	ENETROME COMPRESSI DENSITY - F	TER READ	DING - T.S. IGTH - T.S	F. .F.

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DRING NO. B-10 TE 6-26-01 TE 1556 A A FILE NO. 1656	2406 West EORIA, I	Nebraska	Avenue	,		RING I	
THE THOLE POWER ASH POND EXTEN	SION			HON -E-	. 1		
PRINCE TYPE Hollow-Stem Auger		HER COND	DRILL	Partly	Cloud	y & Mi	Id
RING TYPE HOTTOW STEM ROSS	SEEPA	GE WATER	RENCOU	NTERED A	ELEVAN		52.7 62.5 CAVI
L CLASSIFICATION SYSTEM 475.3	GROU	ND WATER	ELEVATI	ON AT	<u> </u>	. HRS	55.7 IN
RING DISCONTINUED AT ELEVATION 414. 3		ND WATER				Dd	Mc
DESCRIPTION		SAMPLE TYPE	N	Qp	Qu	- 00	1010
Brown SANDY LOAM LOOSE, Brown, Fine-Grained SAND With Some Silty Clay	8"					·	
	-	SS	6	-	-	-	6
,	- 4 -						
oose, Light Brown, Fine-Grained		SS	7	-			8
AND							
		55	7-			<u> </u>	17
	8 -	1					
	<u> </u>	SS	8	 - -		-	14
				 			
	-12-	4 .					
		SS	10	-	_ -		7
Medium-Density, Light Brown, Fine-							
Grained SAND	16_	SS_	13			<u> </u>	6
	-16-			٠			
	F						
	_						
Loose, Light Brown, Fine- To	-20-	SS	9	+		-	3
Medium-Grained SAND		33		 	<u> </u>	+	
	_						
	-24-	1					
	24		_	1		_	19
		SS	8				
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES S - SPLIT SPOON SAMPLE T - SHELBY TUBE SAMPLE	_,	Qu - UN	CONFINE	D PENETRO D COMPRE RY DENSIT	Y - P.C.F.	- %	T.S.F. T.S.F.

BORING LOG BORING NO.B-10 6-26-01 (CONTINUATION) PROJECT Illinois Power Ash Pond Extension LOCATION Havana, Illinois 19 34 SHEET. DESCRIPTION Q_p Q_{u} D.d Мс See Sheet 18 of 34 Medium-Density, Light Brown, Fine-To Medium-Grained SAND 30 SS 13 34 SS 16 38 Medium-Density, Light Brown, Fine-To Coarse-Grained SAND And Fine-Grained GRAVEL SS 25 Medium-Density, Light Brown, Medium- To Coarse-Grained SAND And Fine- To Medium-Grained GRAVEL SS 25 . 46 Medium-Density, Dark Brown, Fine- To Coarse-Grained SAND 50 SS 26 Dense, Dark Brown, Fine- To Coarse-Grained SAND 36 N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE Q_p - Calibrated penetrometer reading - t.s.f. Q_u - unconfined compressive strength - t.s.f. D_d - natural dpy density - p.c.f. M_c - natural moisture content - % - WHITNEY & ASSOCIATES -

ORING NO.B-10	CONTINUA			****	20	05	34
OJECT Illinois Power Ash CATION Havana, Illinois	Folia Excending	· <u> </u>		W. & A. F	ILE NO	- 5 1	556
CATION			I				
DESCRIPTION	DEF IN F	EET TY	PE N	Qp	Qu	D₫	Mc
See Sheet 19 of 34							
Dense, Dark Brown, Medium- Coerse-Grained SND And Fir Medium-Grained GRAVEL	To ne- To	o ss	35	_	_	_	-
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EXPLORATORY BORING DISCO	ONTINUED						}
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DATE 6-28-01 M. & A. FILE NO. 1656 DATE 21 34	2406 West EORIA,	Nebraska	Avenue	3	ВО	RING	LO
PROFEST ILLINOIS POWER ASH POND EXTEN	SION		LOCA	. I ION	vana,	Illin	ois
BORING LOCATION See Plot Plan Sheet BORING TYPE Hollow-Stem Auger		·		Fe Partly	hl Claw	(u 2 M	o a
SORING TYPE HOLLOW-Stem Auger SOIL CLASSIFICATION SYSTEM U.S.B.S.C.		HER CON		NTERED A			452
GROUND SURFACE ELEVATION 467. 6	GROU	IND WATE	RELEVATI	IONAT <u>- 2</u>	24+(P) HAS	453
BORING DISCONTINUED AT ELEVATION 436.6			R ELEVAT	ION AT CO	MPLETIO	N	452
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qр	Qu	D₫	1
Brown SANDY LOAM Loose, Light Brown, Fine-Grained SAND With Some Silty Clay	7*						
		SS	8	-	-	-	
Loose, Brown, Fine-Grained SAND	-						
With Considerable Silty Clay	- 5 -	SS	9	 	-	 -	1
	-						
Loose, Brown, Fine-Grained SAND	 	SS	6	 -		 - -	1
							۲
Loose, Brown, Fine-Grained SAND With Considerable Silty Clay	⊢ 10−	SS	5	 _ -		 	1
etch constderante office ciay	-	20	J			- <u>-</u> -	1
Loose, Brown, Fine-Grained SAND	<u> </u>						_
		SS	5	ļ - -		 -	1
	_15-						_
		SS	4	-		<u> </u>	-
	-20-	SS	8				-
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Medium-Density, Light Brown, Fine- To Coarse-Grained SAND	-						
	-25-	SS	12				+-
		22		<u> </u>		†	\vdash
	F						
Medium-Density, Light Brown, Fine- Grained SAND	-30-						
EXPLORATORY BORING DISCONTINUED		SS	16	-		-	_
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DRING NO.B-12	BORING L				DATE (06-25-	-01
ORING NO.				SHEET		- ^{OF} 18	j
DJECT Illinois Power Ash Pond CATION Havana, Illinois					ILE NO		556
	DEPTH	SAMPLE	N	Tap	Qu	Dd	Mc
DESCRIPTION	DEPTH IN FEET	TYPE	- 14	Qp_			
ee Sheet 23 of 34	ŀ						
ense, Gray-Brown, Fine- To Med Frained SAND And Fine-Grained RAVEL		SS	35	_	<u>-</u>	-	1
EXPLORATORY BORING DISCONTINU	ED _						
	_ 64						
	68				7.6.	50	
	_ 72						
	_ 76				, , , , , , , , , , , , , , , , , , ,		
	_ 80						
	- 84						

XX 302

WHITNEY & ASSOCIATES BORING NOB-13 **BORING LOG** DATE 6-25-01 2406 West Nebraska Avenue W. & A. FILE NO. 1656 PEORIA, ILLINOIS 61604 SHEET 25 OF 34 PROJECT ILLINOIS POWER ASH POND EXTENSION LOCATION Havana, Illinois BORING LOCATION See Plot Plan Sheet DRILLED BY Fehl BORING TYPE Hollow-Stem Auger WEATHER CONDITIONS Partly Cloudy & Mild SOIL CLASSIFICATION SYSTEM __ U. S. B. S. C. 449.0 SEEPAGE WATER ENCOUNTERED AT ELEVATION $_$ GROUND WATER ELEVATION AT 24+ HRS. GROUND SURFACE ELEVATION . 466.5 455.9 _ HRS._ BORING DISCONTINUED AT ELEVATION 405.5 448.6 GROUND WATER ELEVATION AT COMPLETION .. DESCRIPTION DEPTH SAMPLE IN FEET TYPE Qρ Qu D_d Mc Brown SANDY LOAM Loose, Light Brown And Brown, Fine-Grained SAND With Some Silty Clay SS 7 --11 SS 9 10 Very Loose, Light Brown, Fine-Grained SAND SS 8 6 SS 3 _ 4 12-Loose, Light Brown, Fine-Grained SAND SS 6 6 10 -16 Loose, Light Brown, Fine- To Medium-Grained SAND 20 SS 8 18 -24-SS 10 N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - % WHITNEY & ASSOCIATES -

BC	RING L				DATE :	6-25-	01
ning its:	OITAUNITNO	N)				_ OF 16	34
JECT Illinois Power Ash Pond Externation Havana, Illinois	nston			SHEET W. & A. FI	LE NO		56
ATION Havana, IIII	DEPTH	SAMPLE		Qp	Qu	Da	Mc
DESCRIPTION	DEPTH IN FEET	TYPE	- IN	- QP			
ee Sheet 25 of 34							
edium-Density, Gray-Brown, Medium- o Coarse-Grained SAND And Fine- rained GRAVEL	30	SS	12	-	-	-	-
	_34	SS	13	1	-	-	-
	_38						ý
	_ 42	SS	16	-	-	_	
ledium-Density, Brown, Fine- To ledium-Grained SAND Medium-Density, Brown, Medium- To	_ 46	SS	20	-	-	_	
Coarse-Grained SAND	_ 50	SS	23	-	-	-	-
	- 54	SS	18	-	-	-	-

HX 304

PROJECT Illinois Power Ash Pond Exter	nsion			SHEET		OF 16	34
EUCATION				W. & A. F	ILE NO		_
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	Da	
See Sheet 26 of 34							
Medium-Density, Brown, Fine- To Medium-Grained SAND	- -						
	_60	SS	17	_	-	-	
EXPLORATORY BORING DISCONTINUED	-						-
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A FILE NO. 1656	406 West I ORIA, II	Nebraska	Avenue S 61604	i		RING L	
	SION						
See Pibl Fian Blees)4/5 A T L	LEB CONF	DRILLI DITIONS	Partly	Cloud	y & Mi	ld CC O
ING TYPE HOLLOW-SCER MASS							54.4
CLASSIFICATION SYSTEM 481.9	CROU	ND WATER	ELEVATION	DNAT	47(17	HRS	53.8
ing discontinued at elevation 450.9			R ELEVATI				Mc
DESCRIPTION	DEPTH IN FEET	SAMPLE TYPE	N	Qp	Qu	D₁	1016
rown SANDY LOAM	6*					1	
Gray Brown, Fine-Grained							
ND With Some Silty Clay		SS	8	-	-		9
	-						
ose, Light Brown, Fine-Grained	L 5 -		7			-	8
ND		SS_	7	 			
Bart Bran Fire	1		L				
dium-Density, Dark Brown, Fine- mained SAND With Considerable		SS	10		<u>-</u>	ļ <u>-</u> -	9
sined Sand with Consideration				1			
,,	-10-	SS	11				15
	 	ردر	 				
dium-Density, Brown, Fine-Grained			 			 	14
AND With Some Silty Clay		SS	12	<u> </u>	 -	 -	
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	-15-	SS	15	_ = _		<u> </u>	20
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edium-Density, Light Brown, Fine-	-20-	ļ	 	ļ.——	 	+	5
ained SAND	120	SS	13_	 -	 - -	+	
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edium-Density, Light Brown, Fine-	-25-		15	 	 -	† -	5
Medium-Grained SAND		SS	1-13-	 	1		
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	- 30−	CC	13	 			15_
	+	SS_	123				
EXPLORATORY BORING DISCONTINUED	<u> </u>	1	<u> </u>				
BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES - SPLIT SPOON SAMPLE - SHELBY TUBE SAMPLE		Qu - U	ALIBRATE NCONFINI ATURAL D IATURAL N	ED COMPF	TY - P.C.F. CONTENT	, ALNGIII - %	SOCIATE

XX 306

BORING NO. B-15 DATE 6-27-01 W. & A. FILE NO. 1656 SHEET 29 OF 34	2406 West PEORIA,	Nebrask	o a Avenue		ВО	RING	LC
PROJECT ILLINOIS POWER ASH POND EXTE	ENSION		LOCA		vana,	Illin	ois
BORING LOCATION See Plot Plan Sheet BORING TYPE Hollow-Stem Auger			DRIL	LED BY FE	hl		,
SOIL CLASSIFICATION SYSTEM U. S. B. S. C.		HER CON		<u>·</u>	Cloud		$\frac{110}{45}$
GROUND SURFACE ELEVATION 473. 2		AGE WATE JND WATE		INTERED A	T ELEVATI :4+	ON	45
BORING DISCONTINUED AT ELEVATION 412. 2				ION AT CO	MPLETION	. HHS	44
DESCRIPTION	DEPTH	SAMPLE	N	Qp	Qu	Da	T
Brown SANDY LOAM	IN FEET	TYPE	<u> </u>	Стр.	.00	<i>D</i> ₀	igapha
Loose, Brown, Fine-Grained SAND	- -		1				
With Some Silty Clay							
	F			ļ.,			\perp
		SS	5		_		1
	- 4 -						
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	L	SS	6	-	-	-	1
Loop Prous Ping Contact CAND	-						Τ
Loose, Brown, Fine-Grained SAND With Trace Of Silty Clay		SS	8				
water induct of billy oldy	- 8 -	22	•	_	-	-	
	_						T
Loose, Light Brown, Fine-Grained							L
SAND	L	SS	9	-	-	-	
	7.0						
Medium-Density, Light Brown, Fine-	12-				l		
Grained SAND		SS	13	-	-	-	
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	-16-	SS	17				1
	107						
Loose, Light Brown, Fine-Grained	_	ļ					
SAND	 	[
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Loose, Light Brown, Fine- To	-24-						
Medium-Grained SAND							
		SS	8	-	-		1
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER					METER REA		Щ_

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	RING LO			٠		6-27-	
ROJECT Illinois Power Ash Pond Exten	sion			SHEET W. & A. FI	30 LE NO	- ^{OF} 16	34 56
OCATION	DEPTH	SAMPLE		T	Qu	Da	Mc
DESCRIPTION	IN FEET	TYPE	N	Qр		D.0	
See Sheet 29 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	_30	SS	15	-	-	-	-
Medium-Density, Light Brown, Fine- To Coarse-Grained SAND And Fine- Grained GRAVEL	34	SS	18	_		-	-
	38	SS	23	-	•	_	-
Medium-Density, Light Brown, Medium To Coarse-Grained SAND And Fine- Grained GRAVEL	_ 42 _ _ _ 46	SS	24	-	-		-
	<u> </u>	SS	23	_			
	- 54	SS	24	-	-	-	-
N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES SS - SPLIT SPOON SAMPLE ST - SHELBY TUBE SAMPLE		Qti - UNC	ONFINEL	PENETROM COMPRES Y DENSITY DISTURE CO	- P.C.F. NTENT - '	ENG III - 1	OCIATE

13

PROJECT Illinois Power Ash Pond Exten	sion			SHEET _	31	OF 1.6	34 55
				W. & A. F	ILE NO		_
DESCRIPTION	IN FEET	SAMPLE TYPE	N	Qp	Qu	D٥	1
See Sheet 30 of 34							
Medium-Density, Light Brown, Fine- To Medium-Grained SAND	. -						
to heard of affect Samp	_60	SS	26	_	_	_	
EXPLORATORY BORING DISCONTINUED							+
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	_64						
	-						
	-68						
	_66						
	-						
	_72						
	_76						
	,						
	- 80						
	84						
- BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER				ENETROM			<u> </u>

DRING NO. B-16 TE 6-27-01 & A. FILE NO. 1656	2406 West PEORIA,	Nebraska	Avenue	4		RING	
TILINOTS POWER ASH POND EXTEN	SION		LOCA	Ha	vana,	Illin	ois
RING LOCATION See Plot Flair Steet RING TYPE Hollow-Stee Auger IL CLASSIFICATION SYSTEM U. 5. B. S. C. OLIND SURFACE ELEVATION 468. 9	WEAT SEEP/	AGE WATE IND WATE	DITIONS . FR ENCOU R ELEVAT	IONAI	T ELEVAT	ION _ HRS	11d 450. 1 451. 4 449. 7
RING DISCONTINUED AT ELEVATION 407. 9	GROL			ION AT CO			TM
DESCRIPTION	IN FEET	SAMPLE TYPE	N	Qp	Qu	D₄	Mc
cown SANDY LOAM cose, Brown And Light Brown, Fine- irained SAND With Some Silty Clay	8*						
		SS	8	-	1	-	9
	- 4 -						
	_	SS	9	-	-	-	11
Medium-Density, Brown And Light Brown, Fine-Grained SAND	-	SS	15	-			3
Town, Fine district come	8 -						
		SS	19	-		-	4
edium-Density, Light Brown, Fine- o Medium-Grained SAND	- 12-				_		
n neares or arrest some		SS	16	-		-	7
edium-Density, Light Brown, Fine-	-	SS	14		<u>-</u>		4
brained SAND	-16-						
oose, Light Brown, Fine- To	-20-	SS	8	-		_	17
Salva or grass pump							
) :	
	<u></u> -24 -	SS	5	-	-	-	-

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BORING LOG BORING NO.B-16 6-27-01 (CONTINUATION) DATE PROJECT _ Illinois Power Ash Pond Extension 33 34 SHEET LOCATION Havana, Illinois ^{OF} 1656 W. & A. FILE NO. DESCRIPTION SAMPLE TYPE Ν Q_{p} Qu Dσ Мс See Sheet 32 of 34 Medium-Density, Light Brown And Gray-Brown, Fine- To Medium-Grained SAND 30 SS 15 _34 SS 15 38 Medium-Density, Gray-Brown And Light Brown, Fine- To Coarse-Grained SAND SS 17 _ 42 SS 19 - **4**6 50 SS 26 - 54 SS 24 N - BLOWS DELIVERED PER FOOT BY A 140 LB. HAMMER FALLING 30 INCHES
SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE Qp - CALIBRATED PENETROMETER READING - T.S.F. Qu - UNCONFINED COMPRESSIVE STRENGTH - T.S.F. Dd - NATURAL DRY DENSITY - P.C.F. Mc - NATURAL MOISTURE CONTENT - % - WHITNEY & ASSOCIATES -



RING NO.B-16	BORING L	N)			DATE	6-27-	
DJECT Illinois Power Ash Pond E	xtension			SHEET _	34	− ^{OF} 1€	34
OJECT Havana, Illinois					ILE NO		
CATION	DEPTH	SAMPLE	N.	Qp	Qu	Dd	Mc
DESCRIPTION	DEPTH IN FEET	TYPE	N	Qp			
See Sheet 34 of 34						1	
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	60	1			_		-
		SS	23	-			
EXPLORATORY BORING DISCONTINUE	D -						
EAPLORATOR! BOXING DISCHARGE							
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HA 312

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2x2 box culvert under nighway /8 Worksheet for Rectangular Channel

Project Description	on
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	2x2 Box Culvert
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data				_	
Mannings Coefficient	0.013				
Channel Slope	0.0370	00 ft/ft			
Depth	2.00	ft	्र	FULL	FLOW
Bottom Width	2.00	ft	J		

Results		
Discharge	67.11	cfs
Flow Area	4.00	ft²
Wetted Perimeter	6.00	ft
Top Width	2.00	ft
Critical Depth	3.27	ft
Critical Slope	0.011496	ft/ft
Velocity	16.78	ft/s
Velocity Head	4.38	ft
Specific Energy	6.38	ft
Froude Number	2.09	
Flow is supercritical.		

10/08/01 03:24:41 PM

Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15 Page 1 of 1

Check ditch for 1/2 PMP Worksheet for Trapezoidal Channel

Project Descriptio	n
Project File	c:\haestad\fmw\havana3b.fm2
Worksheet	Auxiliary Spillway for Havana Polishing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth
Input Data	
Mannings Coeffici	ent 0.031
Channel Slope	0.009600 ft/ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V
Bottom Width	10.00 ft

100.00

cfs

Results		
Depth	1.33	ft
Flow Area	22.18	ft²
Wetted Perimeter	23.58	ft
Top Width	23.31	ft
Critical Depth	1.19	ft
Critical Slope	0.0149	04 ft/ft
Velocity	4.51	ft/s
Velocity Head	0.32	ft
Specific Energy	1.65	ft
Froude Number	0.81	
Flow is subcritical.		

Discharge

10/08/01 03:18:45 PM

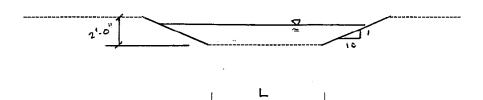
Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 (203) 755-1666

FlowMaster v5.15 Page 1 of 1

HA 314

Auxiliary Spillway Analysis Havana Power Station East Ash Pond #3B October 8, 2001 JHK

Check auxiliary spillway at the polishing pond for the following new flows of ½-PMP storm of 100 cfs and 100-year, 24-hr. storm of 44 cfs. Spillway will act as a weir. Ignore sloping sides when determining capacity of weir.



For the 100 cfs flow, allow H to be up to 1.5' For the 44 cfs flow, allow H to be up to 1.0'

$$Q = CLH^{1.5}$$
 $C = 2.70$

Calculate required width of spillway, L:

For Q= 100 cfs

$$L=100/[(2.7)(1.5)^{1.5}]=20.2$$

For Q= 44 cfs

L=
$$44/[(2.7)(1.0)^{1.5}] = 16.3$$

Existing spillway is 20°. Note: spillway L does not take into consideration sloping portion of spillway, which would increase the flow going through spillway. Also, these flows assume that effluent pipe is completely blocked, which is unlikely. The auxiliary spillway is not needed to meet the state dam safety criteria.



Auxiliary Spillway Analysis Havana Power Station East Ash Pond #3B October 8, 2001 JHK

The stoplog structure in the polishing pond is both the primary and emergency spillway for the pond system. Calculations elsewhere in this document show that it has sufficient capacity for the maximum design storm.

The auxiliary spillway from the polishing pond is an existing one. As part of this new pond 3B, an additional spillway, connecting pond 3B to the polishing pond, will be added. The critical flow, since both the existing spillway and the new spillway are the same size and dimensions, will come from the existing spillway in the polishing pond where the flow is greater. This calculation checks the existing spillway for the higher discharge resulting from adding a new pond to the system.

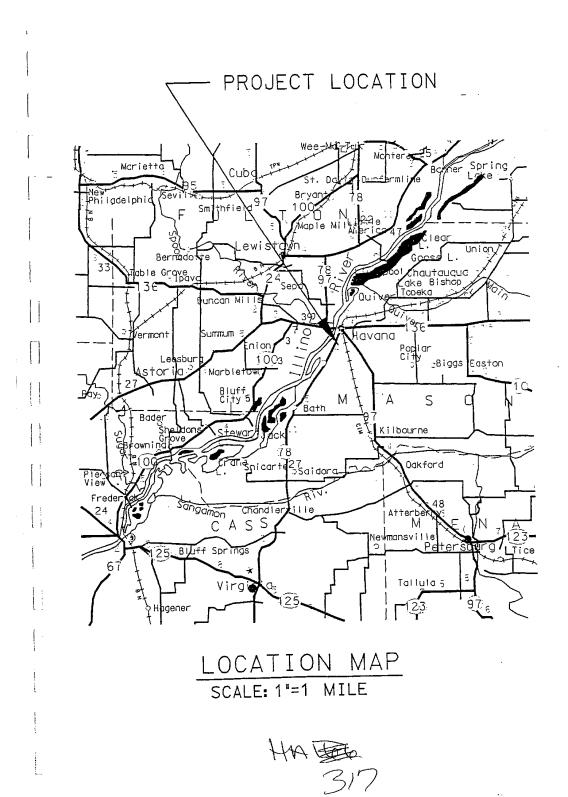
The stoplog structure discharges into a 36-inch round reinforced concrete pipe that routes the water to the Illinois River. Should a blockage ever occur in the 36-inch pipe, performance of the stoplog structure would be reduced. To provide for a controlled discharge in the event of a blockage of the 36-inch pipe, an auxiliary spillway was installed in pond #3 as part of the previous pond addition work. There will also be an auxiliary spillway installed between new pond #3B and polishing pond #3, to provide a path for the water should the outlet for pond #3B become blocked.

Since the auxiliary spillway is not the emergency spillway, but is in addition to it, there is no specified design flow. However, since its purpose is to back up the emergency spillway, it is appropriate to use the same design flows for each. As stated above, the existing spillway for polishing pond #3 has the critical water flow. The design flow for the 100-year, 24-hour storm is 44 cfs, and the design flow for the ½-PMP storm is 100 cfs. The auxiliary spillway was analyzed as a broad crested weir. It has a maximum head of 2-feet. The width is sufficient to carry 44 cfs with a 1-ft head and 100 cfs with a 1.5-ft head.

Any water that discharges over the auxiliary spillway from the polishing pond #3 will flow north parallel to Highway 78 to a 2-ft square box culvert located south of the railroad tracks on the north edge of the pond system. The culvert flows westward under the highway, eventually discharging into a large swale draining into the Illinois River. The box culvert will control the maximum flow into the river. It has a full flow capacity of 67 cfs. Flow in excess of this, would cause minor flooding of the highway.

It would be very unlikely that the auxiliary spillway would ever see a discharge. Regular pond observation by the plant would detect high pond levels and corrective action would be taken. Plant flows can be shut down in a short time if critical pond levels are reached.

HA 316



Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 3 of 8

Response to Request No. 3:

The East Ash Pond System is designed to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist discharges to the East Ash Pond System of the following materials as identified in the Havana Power Station's National Pollutant Discharge Elimination System (NDPES) permit:

Unit 6 bottom ash sluice water Unit 6 dry fly ash handling area drainage Dredged material Units 1-6 demineralizer regenerant wastes Unit 6 condensate polisher wastes

The North Ash Pond System is intended to permanently contain materials in categories (1) fly ash, (2) bottom ash, (3) boiler slag, and (5) other. The category (5) other materials consist of discharges to the North Ash Pond System of the following materials as identified in the Havana Power Station's NPDES permit:

Units 1-6 ash hopper overflow Units 1-6 boiler blowdown Units 1-6 demineralizer regenerant wastes Units 6 condensate polisher wastes Units 1-6 floor and sump drainage Units 1-5 miscellaneous heat exchangers Units 1-5 ash handling equipment drainage Unit 6 coal pile runoff Unit 6 transformer drains Unit 6 roof drainage Yard area runoff Water softener backwash Service water strainer backwash Units 1-6 nonchemical metal cleaning waste Unit 6 cooling tower blowdown Winter low point drain line Accumulated coal barge stormwater Reverse osmosis unit concentrate Reverse osmosis unit maintenance waste Activated carbon treatment system effluent

Groundwater remediation project discharge Units 1-6 water sampling system drains

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 4 of 8

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management units(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

Response to Request No. 4:

The cells of the East Ash Pond System were designed by and constructed under the supervision of a registered Professional Engineer employed by DMG or the previous owner/operator of Havana Power Station, Illinois Power Company. In 2008 and 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the East Ash Pond System. Prior to that, beginning in approximately 1990 and through 2007, the safety of East Ash Pond System was inspected annually by a registered Professional Engineer employed by DMG or Illinois Power Company.

DMG was unable to locate any records to determine whether the North Ash Pond System was or was not designed by a Professional Engineer. DMG was also unable to locate any records to determine whether the North Ash Pond System was or was not constructed under the supervision of a Professional Engineer. In 2009, a Professional Engineer employed by URS Corporation inspected and assessed the safety of the North Ash Pond System.

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

Response to Request No. 5:

DMG last assessed and evaluated the safety (i.e., structural integrity) of both the North Ash Pond System and the East Ash Pond System in March 2009. The East Ash Pond System was also assessed and evaluated for safety in 2008. Those assessments/evaluations were conducted by Ken Berry, a registered Professional Engineer employed by URS Corporation. Mr. Berry, a Senior Project Manager in the Geotechnical Engineering Group of URS Corporation, is a geotechnical engineer with experience in landslides, levees, foundations,

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geotechnical instrumentation, and general construction. His recent experience includes a design project for the New Orleans levees, a load test on an I-wall and levee in New Orleans, and investigations for 30 miles of levee analyses in the counties east of St. Louis, Missouri. Mr. Berry received his BSCE from North Carolina State University in 1989 and his MSCE (geotechnical) from Virginia Polytechnic Institute and State University in 1990. He is registered as a Professional Engineer in Missouri and Illinois and has been employed by URS Corporation since 1991. Prior to 2008 (i.e., beginning in approximately 1990 and through 2007), a registered Professional Engineer employed by DMG or Illinois Power Company (the previous owner/operator of Havana Power Station) with experience in dam safety annually inspected the safety of the cells of the East Ash Pond System.

DMG has not yet received URS' report of the March 2009 dam inspections at Havana Power Station. After receipt of URS' report, DMG will assign a Professional Engineer to ensure that all required corrective actions are implemented. At that time, DMG will determine whether company employees or contractors will be used to perform any identified corrective actions. DMG has not yet had the opportunity to develop or implement any corrective actions.

DMG plans to have a qualified Professional Engineer perform safety (i.e. structural integrity) inspections of both the East Ash Pond System and North Ash Pond System in 2010.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

Response to Request No. 6:

The IDNR OWR last inspected the safety (structural integrity) of the East Ash Pond System prior to the filling each cell with water. Specifically, IDNR OWR last inspected Cell 1 in 1990; Cells 2 and 4 in 1997, and Cell 3 in 2003. IDNR did not provide and DMG does not have copies of those IDNR inspection reports. DMG is not aware of a planned state or federal inspection or evaluation of the East Ash Pond System in the future.

To the best of DMG's knowledge, no federal or state agency regulatory official has inspected or evaluated the safety (structural integrity) of the North Ash Pond System. DMG is not aware of a planned state or federal inspection or evaluation of the North Ash Pond System in the future.

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7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

Response to Request No. 7:

No federal or state regulatory officials have conducted any assessment, evaluation or inspection of the North Ash Pond System or the East Ash Pond System at Havana Power Station within the past year.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of material currently stored in each of the management unit(s). Please provide the date that the volume measurement was taken. Please provide the maximum height of the management units(s). The basis for determining maximum height is explained later in this Enclosure.

Response to Request No. 8:

The East Ash Pond System has a total surface area of 90 acres. The estimated design storage volume of each cell in the East Ash Pond System at normal pool elevation is as follows: Cell 1 - 520 acre-feet (ac-ft); Cell 2 - 620 ac-ft; Cell 3 - 1,410 ac-ft; and Cell 4 - 75 ac-ft. The total estimated design volume of the East Ash Pond System is 2,625 ac-ft. The estimated volume of materials currently stored in each cell is as follows: Cell 1 - 506 ac-ft; Cell 2 - 565 ac-ft; Cell 3 - 310 ac-ft; and Cell 4 - 7 ac-ft. Because no recent volume measurements have been taken for any of the cells in the East Ash Pond System, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of each cell in the East Ash Pond System is approximately as follows: Cell 1 - 25 feet; Cell 2 - 40 feet; Cell 3 - 38 feet; and Cell 4 - 40 feet.

The North Ash Pond System has a surface area of approximately 6 acres. The estimated design storage volume of the North Ash Pond System is 25 ac-ft. The estimated volume of materials currently stored is 5 ac-ft. Because no volume measurements have been taken for the single cell of the North Ash Pond, on or about March 18, 2009, a DMG-employed Professional Engineer estimated the material volumes in order to respond to this question.

The maximum height of the North Ash Pond System is approximately 22 feet.

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9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

Response to Request No. 9:

To the best of DMG's knowledge, there have been no spills or unpermitted releases of coal combustion residues or byproducts to surface water or to the land from either the East Ash Pond System or North Ash Pond System at Havana Power Station in the last ten years.

All discharges from the East Ash Pond System and North Ash Pond System in the last ten years in excess of Havana Power Station's NPDES permit limitations have been reported to the Illinois Environmental Protection Agency, in accordance with NPDES permit reporting requirements. For purposes of responding to this request, DMG did not consider infrequent exceedances of NPDES permit pollutant discharge limits (e.g. TSS) to be "unpermitted releases" within the scope of the EPA's request and, thus, they are not identified in this response. To the extent EPA interprets this request differently, DMG objects to the request because it is vague, overly broad, and too indefinite for reasonable interpretation.

10. Please identify all current legal owner(s) and operator(s) at the facility.

Response to Request No. 10:

Dynegy Midwest Generation, Inc. is the current legal owner and operator of Havana Power Station.

In accordance with and for purposes of the following certification, all portions of this response are hereby identified as information for which the certifying authorized representative cannot personally verify their accuracy.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based

Mr. Richard Kinch US Environmental Protection Agency March 27, 2009 Page 8 of 8

on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: A. Kirk Millis

Name: A. Kirk Millis

Title: Plant Manager

Rich Eimer, Executive Vice President, Generation Operations cc: Keith McFarland, Vice President, Midwest Fleet Operations James Ingram, Vice President & Group General Counsel, Environmental



Photo 1: (EAPS) Cell 1 Along S Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 2: (EAPS) Cell 1 Looking Toward N of Cell 1 (downstream side), Havana Power Plant, Havana, IL, 05.27.09



Photo 3: (EAPS) Cell I, Lower Edge of SW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 4: (EAPS) Cell 1 SE Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 5: (EAPS) Cell 1, SE Toward Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 6: (EAPS) Cell 1, SW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 7: (EAPS) Cell 2, Coal Pile Runoff (mostly storm water), Havana Power Plant, Havana, IL, 05.27.09



Photo 8: (EAPS) Cell 2, NW Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 9: (EAPS) Cell 2, NW Corner Looking at Plant, Havana Power Plant, Havana, IL, 05.27.09



Photo 10: (EAPS) Cell 2, NW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09



Photo 11: (EAPS) Cell 2, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 12: (EAPS) Cell 2 NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 13: (Cell 2) NW Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 14: (EAPS) Cell 2, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 15: (EAPS) Cell 4, Emergency Spillway (along W edge into roadway; towards plant), Havana Power Plant, Havana, IL, 05.27.09



Photo 16: (EAPS) Cell 4, W Edge (energy dissipater of emergency spillway), Havana Power Plant, Havana, IL, 05.27.09



Photo 17: (EAPS) Cell 2, Staff Gage, Havana Power Plant, Havana, IL, 05.27.09



Photo 18: (EAPS) Cell 2, N Edge (looking E toward Cell 3 wetting structure), Havana Power Plant, Havana, IL, 05.27.09



Photo 19: (EAPS) Between Cell 3 and Cell 2 (looking S), Havana Power Plant, Havana, IL, 05.27.09



Photo 20: (EAPS) Cell 3 Extra Fly Ash Basin in SE Corner, Havana Power Plant, Havana, IL, 05.27.09



Photo 21: (EAPS) Cell 3, Fly Ash Outfall Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 22: (EAPS) Cell 3, Looking N From S Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 23: (EAPS) Cell 3, NW Corner (bottom ash outfall area) 1 of 2, Havana Power Plant, Havana, IL, 05.27.09



Photo 24: (EAPS) Cell 3, NW Corner (bottom ash outfall area) 2 of 2, Havana Power Plant, Havana, IL, 05.27.09



Photo 25: (EAPS) Cell 3, NE Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 26: (EAPS) Cell 3, NE Corner Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 27: (EAPS) Cell 3, NE Corner Looking W (abandoned factory), Havana Power Plant, Havana, IL, 05.27.09



Photo 28: (EAPS) Cell 3, NE Corner Looking W Toward Bottom Ash Discharge Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 29: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 30: (EAPS) Cell 3, NE Corner Looking NW Toward Barn-Structure (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 31: (EAPS) Cell 3, NW Corner Looking N Toward Barn Structure, Havana Power Plant, Havana, IL, 05.27.09



Photo 32: (EAPS) Cell 3, NNW Corner (polypropylene liner), Havana Power Plant, Havana, IL, 05.27.09



Photo 33: (EAPS) Cell 3, NNW Corner Looking E, Havana Power Plant, Havana, IL, 05.27.09



Photo 34: (EAPS) Cell 3, NNW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 35: (EAPS) Cell 3, NW Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 36: (EAPS) Cell 3, NW Corner Looking N, Havana Power Plant, Havana, IL, 05.27.09



Photo 37: (EAPS) Cell 3, Open Trough Fly Ash Discharge, Havana Power Plant, Havana, IL, 05.27.09



Photo 38: (EAPS) Cell 3, NW Corner Looking SE, Havana Power Plant, Havana, IL, 05.27.09



Photo 39: (EAPS) Cell 4, Primary Spillway from Cell 4 to River, Havana Power Plant, Havana, IL, 05.27.09



Photo 40: (EAPS) Cell 3, Pipe at SE of Cell 3 (fabrication over synthetic liner), Havana Power Plant, Havana, IL, 05.27.09



Photo 41: (EAPS) Cell 3, Ponding S of Cell 3 at Toe of Embankment (no flow), Havana Power Plant, Havana, IL, 05.27.09



Photo 42: (EAPS) Cell 3, S Edge Embankment (1 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 43: (EAPS) Cell 3, S Edge Embankment (2 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 44: (EAPS) Cell 3, S Edge Embankment (3 of 3), Havana Power Plant, Havana, IL, 05.27.09



Photo 45: (EAPS) Cell 3, S Edge Looking E (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 46: (EAPS) Cell 3, S Edge Looking E (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 47: (EAPS) Cell 3, E Edge Looking S, Havana Power Plant, Havana, IL, 05.27.09



Photo 48: (EAPS) Cell 3, S of Cell 3 Area Leading to Ponding, Havana Power Plant, Havana, IL, 05.27.09



Photo 49: (EAPS) Cell 3, S of Extra Fly Ash Basin, Havana Power Plant, Havana, IL, 05.27.09



Photo 50: (EAPS) Cell 3, SE Corner Looking N (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 51: (EAPS) Cell 3, SE Corner Looking N (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 52: (EAPS) Cell 3, SE Corner Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 53: (EAPS) Cell 3, Staff Gage and Primary Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 54: (Cell 3) SW Edge Corner (cell 4 to the East/right), Havana Power Plant, Havana, IL, 05.27.09



Photo 55: (EAPS) From Toe of Cell 3 (NE corner) Looking Toward Adjacent House, Havana Power Plant, Havana, IL, 05.27.09



Photo 56: (EAPS) From Toe of Cell 3 (NE corner) Looking W, Havana Power Plant, Havana, IL, 05.27.09



Photo 57: (EAPS) Between Cell 3 and Cell 4 Overflow Spillway, Havana Power Plant, Havana, IL, 05.27.09



Photo 58: (EAPS) Cell 3, Vegetation Along S Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 59: (EAPS) Cell 3, W Edge, Havana Power Plant, Havana, IL, 05.27.09



Photo 60: (EAPS) Cell 4, Intersection of Cell 1 and Cell 4 (NE of Cell 1) Mainly Storm Water, Havana Power Plant, Havana, IL, 05.27.09



Photo 61: (EAPS) Cell 4, Looking SE at Cell 1, Havana Power Plant, Havana, IL, 05.27.09



Photo 62: (EAPS) Embankment between Cells 3 and 4 Havana Power Plant, Havana, IL, 05.27.09



Photo 63: (NAPS) Culverts from Coal Pile to NAPS (upstream side), Havana Power Plant, Havana, IL, 05.27.09



Photo 64: (NAPS) Coal Pile Runoff Coming into NAPS, Havana Power Plant, Havana, IL, 05.27.09



Photo 65: (NAPS) Coal Runoff (culverts connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09



Photo 66: (NAPS) Coal Runoff (culvert connecting two NAPS cells), Havana Power Plant, Havana, IL, 05.27.09



Photo 67: (NAPS) Into Downstream Pond, Havana Power Plant, Havana, IL, 05.27.09



Photo 68: (NAPS) Wall of Incision, Havana Power Plant, Havana, IL, 05.27.09



Photo 69: (NAPS) Upstream (plant behind), Havana Power Plant, Havana, IL, 05.27.09



Photo 70: (NAPS) West of NAPS Looking at IL River, Havana Power Plant, Havana, IL, 05.27.09



Photo 71: (NAPS) Looking S at Incision Wall, Havana Power Plant, Havana, IL, 05.27.09

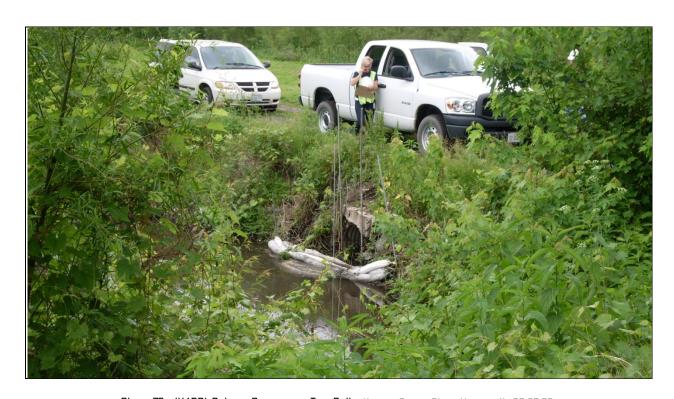


Photo 72: (NAPS) Culvert Connecting Two Cells, Havana Power Plant, Havana, IL, 05.27.09



Photo 73: (SAPS) Southernmost Embankment Looking East, Havana Power Plant, Havana, IL, 05.27.09



Photo 74: (SAPS) Looking East Over Capped Cell, Havana Power Plant, Havana, IL, 05.27.09



Photo 75: (SAPS) Overlooking Closed Pond (1 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 76: (SAPS) Overlooking Closed Pond (2 of 2), Havana Power Plant, Havana, IL, 05.27.09



Photo 77: (SAPS) Stop Log Structure (similar design to EAPS), Havana Power Plant, Havana, IL, 05.27.09



Photo 78: (SAPS) Westernmost Embankment Looking S, Havana Power Plant, Havana, IL, 05.27.09

Unit I.D.: Hazard Potential Classification High Significant Low	Site Name: Havana Power Pla	int		Date: 5/27/07		3.7126
Unit I.D.: Hazard Potential Classification High Significant Low Inspector's Name: Classification Suith / Lauren One 12ke Check the appropriate by below. Provide comments when appropriate. If not applicable or not available, record "Na". Any unusual conditions or construction practices that should be noted in the comments when appropriate area that the form applies to in comments. Yes No Yes No 1. Frequency of Company's Dam Inspections?			4001	Operator's Name: Dynegy		
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Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "NA". Any unusual conditions or construction practices that should be noted in the comments section. For large disked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments. Yes No Yes No 1. Frequency of Company's Dam Inspections? 2. Pool elevation (operator records)? 2. Pool elevation (operator records)? 3. Decant inter elevation (operator records)? 4. Open channel spillway elevation (operator records)? 5. Lowest dam crest elevation (operator records)? 6. If instrumentation is present, are readings recorded (operator records)? 7. Is the embankment currently under construction? 8. Foundation preparation (remove vegetation stumps, topsoil in area where embankment fill will be placed)? 9. Trees growing on embankment? (if so, indicate largest diameter below) 10. Cracks or scarps on crest? 11. Is there significant settlement along the crest? 12. Are decant trashracks clear and in place? 13. Depressions or sinkholes in tailings surface or whirpool in the pool area? 14. Clogged spillways, groin or diversion ditches? 15. Are spillway or ditch linings deteriorated? 16. Are outlets of decant or underdrains blocked? 17. Cracks or scarps on stopes? Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet. Inspection Issue # Comments ** ** ** ** ** ** ** ** **		Mitt	γ/Lc	aurenohotzke		
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S. Hinstrumentation is present, are readings recorded (operator records)? 7. Is the embankment currently under construction? 8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)? 9. Trees growing on embankment? (If so, indicate largest diameter below) 10. Cracks or scarps on crest? 11. Is there significant settlement along the crest? 12. Are decant trashracks clear and in place? 13. Depressions or sinkholes in tailings surface or whirlpool in the pool area? 14. Clogged spillways, groin or diversion ditches? 15. Are spillway or ditch linings deteriorated? 16. Are outlets of decant or underdrains blocked? 17. Cracks or scarps on slopes? Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in the back of this sheet. Inspection Issue # Comments		N/	A		-	X
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16. Are outlets of decant or underdrains blocked? 23. Water against downstream toe? 24. Were Photos taken during the dam inspection? Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet. Inspection Issue # Comments #/ Standing water in areas of the but was	14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?	N	114
17. Cracks or scarps on slopes? Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet. Inspection Issue # Comments #/ Standing water in areas of the but was	15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
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further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet. Inspection Issue # Comments #/ Standing water in areas of the but was	17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	×	
#1 Standing water in areas of toe, but was	further evaluation. Adverse conditions no volume, etc.) in the space below and on the	ted in t e back	hese it of this	ems should normally be described (extent,	locatio	n,
The state of the s	Inspection Issue #	Comm	nents		4	***************************************
deemed to be from recent rain,	#1 Standing	Wai	ter	in areas of toe bu	1	Nas
atemed to be now recent vain.				C. cost to		
	atenea	LA	bl .	Now recent rain,		***************************************
		4				

U. S. Environmental Protection Agency



Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # Date	INSPECTOR Lawren Ohotzke
Impoundment Name Havana - East / Impoundment Company Dynegy EPA Region I State Agency (Field Office) Addresss III:n	
Name of Impoundment East Ash Police (Report each impoundment on a separate form) Permit number)	inder the same Impoundment NPDES
New Update	
Is impoundment currently under construction? Is water or ccw currently being pumped into the impoundment? IMPOUNDMENT FUNCTION:	Yes No X
Latitude 40 Degrees	
Does a state agency regulate this impoundment	? YESX NO
If So Which State Agency? 11112013 Dept	of Natural Resources of Don Safety
EPA Form XXXX-XXX, Jan 09	1

LESS THAN LOW HAZARD POTENTIAL: Failure or misoperation are dam results in no probable loss of human life or economic or environmental passes.	n of
LOW HAZARD POTENTIAL: Dams assigned the low hazard poten lassification are those where failure or misoperation results in no probable loss uman life and low economic and/or environmental losses. Losses are principa mited to the owner's property.	s of
SIGNIFICANT HAZARD POTENTIAL: Dams assigned the signification are those dams where failure or misoperation rest no probable loss of human life but can cause economic loss, environmental amage, disruption of lifeline facilities, or can impact other concerns. Significal azard potential classification dams are often located in predominantly rural or gricultural areas but could be located in areas with population and significant infrastructure. HIGH HAZARD POTENTIAL: Dams assigned the high hazard otential classification are those where failure or misoperation will probably causes of human life.	ults
DESCRIBE REASONING FOR HAZARD RATING CHOSEN: Homes are located immediately downstre of cell #3. Also It DNR-Day Sofety has classified this system as high hazard.	<u> </u>

CONFIGURATION: CROSS-VALLEY SIDE-HILL DIKED INCISED Cross-Valley Side-Hill × Diked Incised (form completion optional) Combination Incised/Diked Embankment Height max ~ 40 feet Embankment Material Sand fash, clay Pool Area go acres Liner Clay, geo-membrane feet Liner Permeability being provided 3 EPA Form XXXX-XXX, Jan 09

Open Char Trapezoida Triangular Rectangula Irregular		TRAPEZOIDAL Top Width Depth Bottom	TRIANGULAR Top Width Depth
depth	average) width	RECTANGULAR Depth Width	Average Width Avg Depth
Outlet			
inside diam	eter		
			Inside Diameter
Is water flowing the	nrough the outlet?	? YES N	0
No Outlet			
		DROP STRE	ICTURE W/ STOP LOG
			TO CULLERE WHICH
The Impoundment	was Designed B	INDIS RIVER Y DAVID GASA	CINS, RE PROVINCE

	een a failure at this site?	NO	Λ
If So Please Des			
EPA Form XXXX-XXX			

If So When? N/A
IF So Please Describe:

Has there ever been any mea Phreatic water table levels be at this site?	ased on past seepages	or breaches YES	_NOX	advantadiseb
If so, which method (e.g., pie	ezometers, gw pumpi	ng,)? <u>N/A</u>		
If so Please Describe:				
EPA Form XXXX-XXX, Jan 09				

Site Name: Havana Powe Unit Name: North Ash Pond Unit I.D.:	system	1 (20	Hazard Potential Classification: High Sign	gnificant Low
onstruction practices that should be noted in the combankment areas. If separate forms are used, ide	onts when appropri- comments section. entify approximate	For lar area th	ne diked embankments, separate checklists may be used for	onditions or or different Yes No
SEE NOTE BELOW	Yes	No		100 100
Frequency of Company's Dam Inspections?	N/	<u>A</u>	18. Sloughing or bulging on slopes?	NIA
2. Pool elevation (operator records)?	N _I	/A	19. Major erosion or slope deterioration?	N/A
3. Decant inlet elevation (operator records)?	N/	A	20. Decant Pipes:	
4. Open channel spillway elevation (operator reco	STATE OF THE STATE	/A-	Is water entering inlet, but not exiting outlet?	N / /A
5. Lowest dam crest elevation (operator records)	? N/	IA	Is water exiting outlet, but not entering inlet?	NIA
6. If instrumentation is present, are readings recorded (operator records)?	N/	14	Is water exiting outlet flowing clear?	MA
7. Is the embankment currently under construction	on? N	/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	
8. Foundation preparation (remove vegetation,stutopsoil in area where embankment fill will be place	ced)?	14	From underdrain?	NIA
Trees growing on embankment? (If so, indicate largest diameter below)	e N	14	At isolated points on embankment slopes?	NA
10. Cracks or scarps on crest?	N	14	At natural hillside in the embankment area?	NA
11. Is there significant settlement along the crest	? N	/A	Over widespread areas?	N/A
12. Are decant trashracks clear and in place?	N	1A	From downstream foundation area?	NYA
13. Depressions or sinkholes in tailings surface of whirlpool in the pool area?	or N	/A	"Boils" beneath stream or ponded water?	NIA
14. Clogged spillways, groin or diversion ditches	? N/	A	Around the outside of the decant pipe?	N/A
15. Are spillway or ditch linings deteriorated?	N	<u> </u>	22. Surface movements in valley bottom or on hillside?	NIT
16. Are outlets of decant or underdrains blocked	? N	A	23. Water against downstream toe?	NIA
17. Cracks or scarps on slopes?	N	A	24. Were Photos taken during the dam inspection?	X
volume, etc.) in the space below and	ons noted in t	these i	tems should normally be described (extent, I	location,
Inspection Issue #				
* 1	HE NOR	TH ,	ASH POND SYSTEM IS	NOT AI
es de la companya de	n POUND!	MEN	T, BUT AN INCISION, A	LS0, 17
	ECEIVES	5 (COAL PILE RUNDEF, NO	T ccu
<i>b</i>	MOST	OF	CHECKLIST IS NOT	APPLICA

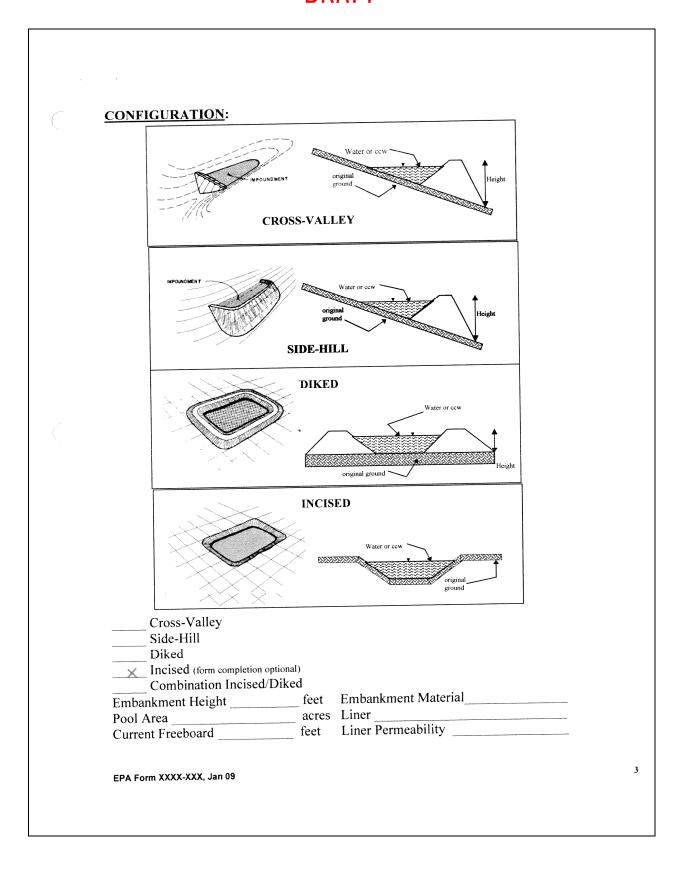
U. S. Environmental Protection Agency



Coal Combustion Waste (CCW) N/A

	impoundine	nt inspection	
Impoundment NPDE	S Permit #	INSPECTOR	cleightensmith/ Laurenohotzke
Date			
Impoundment Cor EPA Region	ld Office) Addresss		
Name of Impound (Report each impo Permit number)	mentoundment on a separate form	under the same Imp	oundment NPDES
NewU	pdate		
Is impoundment c Is water or ccw cu the impoundment	urrently under constructionsurently being pumped into?	Yes	
IMPOUNDMEN	T FUNCTION:		
Nearest Downstre Distance from the Impoundment Location:	Longitude 10 Degree Latitude 1 County	s <u>04</u> Minutes <u>4</u> 8 16 Minutes <u>3</u>	4.59 Seconds
Does a state agen	cy regulate this impoundmen	nt? YESNO	<u></u>
If So Which State	Agency?	***	
EPA Form XXXX-XXX,	Jan 09		1

NIA
HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):
the dam results in no probable loss of human life or economic or environmental losses.
LOW HAZARD POTENTIAL: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
hazard potential classification are those dams where failure or misoperation result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably caus loss of human life.
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:
EDA Farm VVVV VVV Inn 00
EPA Form XXXX-XXX, Jan 09



Open Channel Spillway	TRAPEZOIDAL	TRIANGULAR
Trapezoidal Triangular Rectangular Irregular	Top Width Depth Bottom Width	Top Width Depth
depth bottom (or average) width top width	RECTANGULAR Depth Width	IRREGULAR Average Width Avg Depth
Outlet		
inside diameter		
Material corrugated metal welded steel concrete plastic (hdpe, pvc, etc.) other (specify)		Inside Diameter
Is water flowing through the outle	et? YESNO)
No Outlet		
Other Type of Outlet (spe	ecify)	
The Impoundment was Designed	Ву	

Has there ever been a failure at this site? YES	NO
If So When?	
If so I lease Desertee.	
EPA Form XXXX-XXX, Jan 09	

If So When? IF So Please Describe:	Has there ever been significant seepages at this	site? YES	NO
IF So Please Describe:		And And Add Add Add Add Add Add Add Add	and the state of t
	If So When?		
	IF So Please Describe:		
EPA Form XXXX-XXX, Jan 09			

Has there ever been any measures ur	ndertaken to monitor/lower	
Phreatic water table levels based on at this site?	past seepages or breaches YES	NO
If so, which method (e.g., piezomete	ers, gw pumping,)?	
If so Please Describe:		
EPA Form XXXX-XXX, Jan 09		

Havana Power Plant Site Visit Attendance Sheet

May 27, 2009

Name	Company	Phone	E-mail
Rick Diericx	Dynegy	618-206-5912	Rick Diericx Dynegy.com
David Gaskins	Engineering Design Services	217-692-2685	david@eds7.com
Jim Watson	Dynegy-HA	309-543-8777	jim.watson@dynegy.com
Phil Morris	Dynegy	618-206-5934	phil.marris@dynegy.com
Joe Kimlinger	Dynegy	618-410-6534	<u>joe.kimlinger@dynegy.com</u>
Chris Lieberman	IEPA/BOL/Permits	217-524-3294	<u>chris.lieberman@illinois.gov</u>
Ted Dragovich	IEPA	217-524-3306	ted.dragovich@illinois.gov
Doug Van Nattan	IEPA/BOL/Permits	217-524-7505	doug.vannattan@illinois.gov
Ken Berry	URS	314-429-0100	kenneth_berry@URScorp.com
Cleighton Smith	Dewberry	856-802-0843	cleighton.smith@dewberry.com
Lauren Ohotzke	Dewberry	856-802-0843	lohotzke@dewberry.com

Havana Power Plant Meeting Notes

May 27, 2009

- Dam Safety Assessment
 - o Records, Design Drawings, Calculations, etc.
 - Visual Observation
- Ken (URS) did previous inspection in November
- Almost all drawings of cells done by Dynegy
 - Cleighton reviewed all drawings, placing post-its on those he wanted electronic copies of (Dynegy would be providing those docs)
- Testing done to reach ground water was performed to see if ash is leaking into wells, etc.
- Cells 1, 2, 3, 4 (polishing pond)
- Calculations reviewed
 - $_{\odot}$ Copy of entire calc documents (all done by Dynegy) will be send via PDF to Cleighton
- Breach mapping done to determine speed which would flow out
 - No banks to contain downstream flow so it is difficult to model because the flow could go "anywhere" and "everywhere"
- Height of embankment (max. height) needed for cells in question
 - Reference contour for elevations and slope determination of cell walls (will also be available in calculations)
- Any breach would go right into the Illinois River
- No major housing settlements near "closed" western cell (all along the Illinois River)
- Contact Phil for URS stuff (not Ken, directly)
- ~50% ash sold

Havana Power Plant Site Walk Notes

Π9

- Overall High Hazard
- Plant not operating during our visit due to shut down for construction
- Cells 1, 2, 3, 4 are lined (have an impervious layer)
- Cells on river side are note lined (do not have an impervious layer)
- Culverts are checked daily to insure clear/not cloqged
- N. Ash Pond System (NAPS) communicates from 1 side of "road" to the other
- Downstream of (NAPS) looks more like an incision than an impoundment
- No combustion waste maintained (no DNR permits)
- Tertiary cell of NAPS (inactive)
 - All cleaned out
 - No longer takes CCW
 - Only water other than rain water from the dredging of river spoils
- Ash lines running under roadway to cells 1 through 4
 - Lined/covered in a fabric with solid concrete/mortar/grout (no aggregate) pumped into it
- Cell 1 (scalping pond)
 - Mostly closed (over half)
 - Not accepting any new ash
 - Physically, the piping is not hooked up
 - Typically mow top of embankment until where slope makes unsafe for mowers
 - Trees along just beyond tow of embankment
 - SE corner= no trees, just grass
 - NE mainly storm water
- Cell 3
 - Some ponding along S edge
 - Extra fly ash basin in SE corner

Havana Power Plant Site Walk Notes

May 27,